VISIBLE/INFRARED IMAGER/RADIOMETER SUITE (VIIRS)

Sensor Requirements Document (SRD)

for

NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS) SPACECRAFT AND SENSORS

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Table of Contents

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1 SCOPE

1.1 IDENTIFICATION

This Sensor Requirements Document (SRD) sets forth the requirements for the Visible/Infrared Imager/Radiometer Suite of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) and is hereinafter referred to as the VIIRS.

1.2 SENSOR SUITE OVERVIEW

The purpose of the VIIRS is to collect visible and infrared radiometric data. These data are processed and delivered to the users in the form of Raw Data Records (RDRs), Sensor Data Records (SDRs), and Environmental Data Records (EDRs).

1.3 DOCUMENT OVERVIEW

This document contains all performance requirements for **the** sensor suite. This document also defines all sensor-spacecraft interfaces for the sensor suite. The contractor should use the document as the basis of a proposed sensor suite specification. The documentation listed in section 2.0 follows an approach of minimum specs and standards. The contractor may add to or revise the documents listed in section 2.0 in coordination with the government. The term **"(**TBD**)"** applied to a missing requirement means that the contractor should determine the missing requirement in coordination with the government. The term **"(**TBS**)"** means that the government will supply the missing information in the course of the contract. The term **"(**TBR**)"** means that the requirement is subject to review for appropriateness by the contractor or the government. The government may change **"(**TBR**)"** requirements in the course of the contract.

Appendix A contains a definition of the terms used throughout the document. Appendix B, NPOESS survivability requirements, is classified and will be made available after contract award. Appendix C is a Sensor Data Record Characteristics section presently TBR. Appendix E contains the RDRs and EDRs required for each Central and Field Terminal (TBR). Appendix F defines the acronyms and abbreviations used throughout the document. Appendix G describes Potential Pre-Planned Product Improvements. Appendix H is the Verification Cross Reference Matrix (TBD). **The TRD Appendix D contains the NPOESS EDR requirements.**

1.3.1 CONFLICTS

SRDX1.3.1-1
In the event of conflict between the referenced documents and the contents of this specification, the contents of this specification shall be the superseding requirements.

SRDX1.3.1-2
In the event of a conflict involving the external interface requirements, or in the event of any other unresolved conflict, the contracting officer shall determine the order of precedence.

1.3.2 REQUIREMENT WEIGHTING FACTORS

The requirements stated in this specification are not of equal importance or weight. The following three paragraphs define the weighting factors incorporated in this specification.

a. ***Shall*** designates the most important weighting level; that is, mandatory. Any deviations from these contractually imposed mandatory requirements require the approval of the contracting officer.

b. ***Should*** designates requirements requested by the government and are not mandatory. Unless required by other contract provisions, noncompliance with the *should* requirements does not require approval of the contracting officer.

d. ***Will*** designates the lowest weighting level. These *will* requirements designate the intent of the government and are often stated as examples of acceptable designs, items, and practices. Unless required by other contract provisions, noncompliance with the *will* requirements does not require approval of the contracting officer and does not require documented technical substantiation.

1.4 SYSTEM CLASSIFICATIONS N/A

2 APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

The following documents, of the exact issue shown, form a part of this SRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, see Section 1.3.1. Tailoring of documents in this section is (TBR).

SPECIFICATIONS:

Military

DOD-E-83578A May 96	General Specification for Explosive Ordnance for Space Vehicles
Mil-A-83577B Feb 88	Moving Mechanical Assemblies for Space Launch Vehicles

STANDARDS:

Federal

FED-STD-209E Sep 92	Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones

Military

MIL-STD-461D Jan 93	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462D Jan 93	Measurement of Electromagnetic Interference Characteristics
MIL-STD-1540C Sep 94	Test Requirements for Launch, Upper Stage, and Space Vehicles
MIL-STD-1541A Dec 87	Electromagnetic Compatibility Requirements for Space Systems
MIL-STD-1553B Jan 96	Digital Time Division Command/Response Multiplex Data Bus
MIL-STD-1773B May 88	Fiber Optics Mechanization of an Aircraft Internal Time Division Command/Response Multiplex Data Bus

Department of Commerce/NOAA None (TBR)

OTHER PUBLICATIONS:

Regulations

AFM 91-201 7 Oct 94	Explosive Safety Standards
EWR 127-1 31 Mar 95	Eastern and Western Range Safety Requirements

Handbooks None (TBR)

Bulletins None (TBR)

Other

GPS ICD 200 REV C 19 January 1995	"NAVSTAR GPS Space Segment/Navigation User Interface"(U)
GPS ICD 203, REV B 22 Dec 1993	"NAVSTAR GPS SA/AS Requirements" (U)-SECRET

(Contractors requiring copies of specifications, standards, handbooks, drawings, and publications in connection with specified acquisition functions should obtain them from the contracting activity or as directed by the contracting officer.)

2.2 NONGOVERNMENT DOCUMENTS

The following documents of the exact issue shown form a part of this SRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, see Section 1.3.1.

SPECIFICATIONS: None (TBR)

STANDARDS:

CCSDS 203.0-B-1 Jan 87	CCSDS Recommendations for Space Data System Standards. Telecommand, Part 3: Data Management Service, Architectural Definition, Issue 1
CCSDS 701.0-B-2 Dec 87	CCSDS Recommendations for Advanced Orbiting Systems, Networks and Data Links, Architectural Specification
National Aerospace Standard (NAS) 411 Rev 2, 29 Apr 94	Hazardous Materials Management Program

DRAWINGS: None (TBR)

OTHER PUBLICATIONS: None (TBR)

2.3 REFERENCE DOCUMENTS

The following documents are for reference only and do not form a part of this specification. They are listed here because various parts of the SRD refer to them.

SPECIFICATIONS:
Military None (TBR)

STANDARDS:

DOD 5200.28-STD Mar 88	Department of Defense Trusted Computer System Evaluation Criteria
MIL-STD-129M 1 Jun 93	Marking for Shipment and Storage Notice 1, 15 Sep 89
MIL-STD 961D Aug 95	DoD Standard Practice for Defense Specifications, w/ Notice 1
MIL-STD-498 5 Dec 94	Software Development and Documentation
MIL-STD-882c Jan 93	System Safety Program Requirements
MIL-STD-1246C Apr 94	Military Standard Product Cleanliness Levels and Contamination Control Program
MIL-STD-1522A May 84	Standard General requirements for Safe Design and Operation of Pressurized Missile and Space Systems
MIL-STD-1542B Nov 91	Electromagnetic Compatibility (EMC) and Grounding Requirements for Space Systems Facilities
MIL-STD-1543B Oct 88	Reliability Program Requirements for Space and Launch Vehicles
MIL-STD-1547A Dec 92	Parts and Materials Program for Space and Launch Vehicles
MIL-STD-1809 Feb 91	(USAF) Space Environments for USAF Space Vehicles

TM-86-01	Technical Manual Contract Requirements

Department of Commerce

DOC Sep 95 Edition Sep 95	National Telecommunications and Information Administration, Manual of Regulations for Federal Radio Frequency Management

NOAA

S24.801 2 Dec 88	Preparation of Operations and Maintenance Manuals
S24.806 30 Apr 87	Software Development, Maintenance, and User Documentation
S24.809 Dec 89	Grounding Standards

NASA

PPL-21 March 1995	Preferred Parts List, Goddard Space Flight Center (Updated May 1996)
SP-R-0 022A (JSC) 9 Sep 74	General Specification, Vacuum Stability Requirements of Polymeric Material for Spacecraft Application
NASA Tech Memo 100471	Orbital Debris Environments for Spacecraft Designed to Operate in Low Earth Orbit
SP 8031 1969	NASA Space Vehicle Design Criteria/Structures

OTHER PUBLICATIONS:

Regulations None (TBR)

Handbooks

DOD-HDBK-263B (date)	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies, Equipment
MIL-HDBK-340 1 Jul 85	Application Guidelines for MIL-STD-1540B
DOD-W-83575 Jun 96	Gen Spec for Wiring Harness, Space Vehicle, Design and Testing

MIL-I-46058	Insulating Compound. Electrical (for Coating Printed Circuit Assemblies)
1985	Handbook of Geophysics and Space Environments
AFM 15-111 1 Sep 96	Surface Weather Observations

Bulletins **None**

Other

TRD for NPOESS (current version)	Technical Requirements Document (TRD) for National Polar- Orbiting Operational Environmental Satellite System (NPOESS) Spacecraft Payloads
IRD for NPOESS (current version)	Interface Requirements Document (IRD) for National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Spacecraft
IORD for NPOESS 28 Mar 96	Integrated Operational Requirements Document (IORD) for National Polar Orbiting Operational Environmental Satellite System (NPOESS) Spacecraft Payloads
ASTME-595-93 (current version)	Standard Test method for Total Mass Loss and Collected Volatile Condensable Materials for Outgassing in a Vacuum Environment
Attachment C S-480-80 Revised December 1994	AMSU-A Instrument Performance and Operation Specification (for the EOS/METSAT Integrated Programs); NASA GSFC
SYS/AMS/J0105/BAE 03 Feb 1993	AMSU-B Instrument System Specification (British Aerospace)

(Technical society and technical association specifications and standards are generally available from reference libraries. They are also available in technical groups and using federal agencies. Contact the contracting officer regarding any referenced document not readily available from other sources.)

3 SENSOR REQUIREMENTS

3.1 DEFINITION

3.1.1 VIIRS DESCRIPTION

SRDV3.1.1-1
The VIIRS shall consist of one or more instruments designed to measure scene radiance in spectral bands within the visible to thermal infrared range (from 0.3 to 14 microns, approximately).

SRDV3.1.1-2
The contractor shall determine the sensor architecture, that is, the number of instruments and discrete modules comprising the sensor suite.

The contractor is responsible for determining the sensor characteristics and performance requirements needed to satisfy a specified subset of the Environmental Data Record (EDR) requirements. (See Sec. 3.2.1)

The possibility that the government may choose to fly a VIIRS instrument on a "mission of opportunity" satellite to provide early NPOESS data to users should not be construed to imply any additional or more stringent constraints on the VIIRS design.

3.1.1.1 Specification Tree

Figure 3.1.1.1 shows a partial specification tree for the NPOESS System.

SPECIFICATION TREE

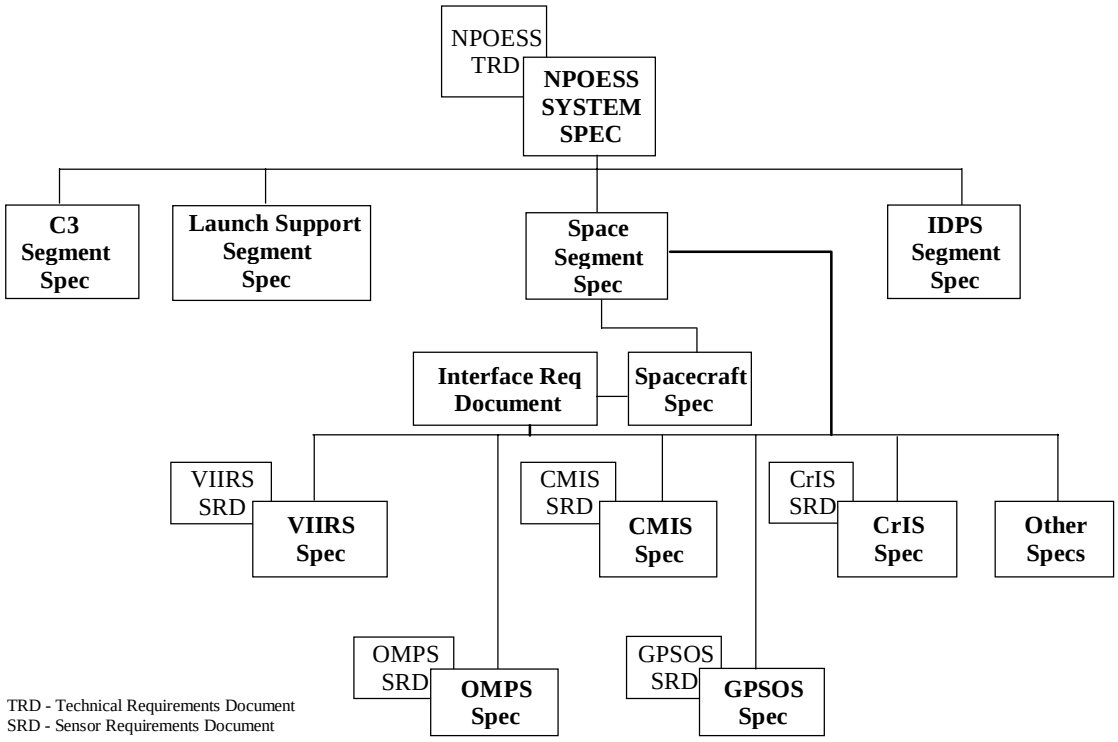

Figure 3.1.1.1 PARTIAL SPECIFICATION TREE

3.1.2 TOP-LEVEL VIIRS FUNCTIONS

SRDV3.1.2-1
Each VIIRS instrument shall perform the following functions throughout its operational lifetime:

- scene radiance measurement
- end-to-end on-orbit radiometric calibration of all spectral bands
- acquisition of sensor health, status, and thermal data
- generation of Low Data Rate (LDR) and High Data Rate (HDR) data packets containing scene radiance, calibration, monitoring, health, and status data
- reception of command and control data
- assuming the physical configuration and generating the data required for each functional mode
- accommodating the uplinking of new flight software packages

Each VIIRS instrument should perform the following functions, if needed to meet requirements, based on the contractor's design:

- on-orbit monitoring of calibration sources and instrument response changes
- gain adjustments to meet dynamic range requirements

3.1.3 SENSOR MODES

SRDV3.1.3-1
The VIIRS shall implement the following operational modes as a minimum:

- OFF Mode
- OUTGASSING Mode
- ACTIVATION Mode
- EARLY ORBIT CHECKOUT Mode
- OPERATIONAL Mode
- DIAGNOSTIC Mode
- SAFE HOLD Mode
- SURVIVAL Mode

In addition, the VIIRS will implement one or more CALIBRATION Modes, if needed.

SRDV3.1.3-2
Each VIIRS instrument shall be separately commandable into any of the above modes, regardless of the operational mode of any other instrument in the suite or on the spacecraft. The contractor may recommend additional modes or submodes, as appropriate to his specific design and operational concept.

3.1.3.1 Common Sensor Modes

The OFF, OPERATIONAL, DIAGNOSTIC, and SAFE HOLD modes are common to all NPOESS mission critical sensors.

3.1.3.1.1 OFF Mode

SRDV3.1.3.1.1-1
In the sensor OFF mode, no power shall be supplied to the sensor, with the possible exception of power to survival heaters and critical health and safety monitoring components.

3.1.3.1.2 OPERATIONAL Mode

SRDV3.1.3.1.2-1
In the OPERATIONAL mode the VIIRS shall be in its full functional configuration.

SRDV3.1.3.1.2-2
In this mode, Earth scene radiance, calibration, and housekeeping data shall be acquired.

3.1.3.1.3 DIAGNOSTIC Mode

SRDV3.1.3.1.3-1
The sensor DIAGNOSTIC mode shall support housekeeping and software updates.

SRDV3.1.3.1.3-2
The DIAGNOSTIC mode shall support trouble shooting.

3.1.3.1.4 SAFE HOLD Mode

In the SAFE HOLD mode, health and status data are collected and transmitted. Mission and calibration data are not collected.

SRDV3.1.3.1.4-1
The SAFE HOLD mode is a power conservation mode. The sensor shall accept a command in the event the spacecraft enters an anomalous configuration or orientation as determined by the spacecraft computer. A power subsystem anomaly is such an event.

SRDV3.1.3.1.4-2
The spacecraft C&DH will issue power conservation re-configuration commands to the sensors via the data bus that will place the sensor in a safe configuration. The return to the OPERATIONAL mode shall require ground intervention.

SRDV3.1.3.1.4-3
In this mode, most components shall be turned off, with survival heaters activated (See 3.1.4.2.7).

3.1.3.2 VIIRS-Unique Mode and Submode Requirements

3.1.3.2.1 OFF Mode

The VIIRS will be in the OFF mode during launch phase and orbit acquisition. To the maximum extent feasible, the VIIRS should be designed to allow the spacecraft to monitor its health and safety while in the OFF mode. For example, critical instrument temperatures may be monitored by the spacecraft.

SRDV3.1.3.2.1-1
Thermostatically controlled survival heaters connected to a separate power bus shall be provided, as necessary, to protect the instrument in this mode.

3.1.3.2.2 OUTGASSING Mode

SRDV3.1.3.2.2-1
The VIIRS will be in the OUTGASSING mode during the early days of the mission, during which time the instruments shall be non-operating or in partial operation. This mode may also be exercised at any time during the mission when decontamination is required. Instrument subassemblies or components are powered on in this mode only as necessary to facilitate outgassing, not to provide valid Earth scene or calibration data.

SRDV3.1.3.2.2-2
In this mode, the optics, cooler, and other critical components shall be protected from contamination.

SRDV3.1.3.2.2-3
This mode shall also include the capability to warm up any cold critical elements to allow any contamination build-up to outgas.

3.1.3.2.3 ACTIVATION Mode

In the ACTIVATION mode the VIIRS turns on and instrument components are warming up, or cooling down, to their operating temperatures. This mode terminates when all instrument temperatures, biases, and currents have stabilized within specified operational limits.

This mode also includes any deployments and opening of covers or shutters.

3.1.3.2.4 EARLY ORBIT CHECKOUT Mode

The EARLY ORBIT CHECKOUT mode is a test mode in which the VIIRS collects data to verify that performance complies with design and meets requirements. This mode may be regarded as a submode of the common sensor DIAGNOSTIC Mode.

SRDV3.1.3.2.4-1

To support this mode and for anomaly resolution, the contractor shall provide the capability to selectively disable any on-orbit processing operation that combines or compresses raw data in any manner. Examples of such processing operations are: spatial aggregation of pixel samples; temporal aggregation of pixel samples; averaging of pixel data acquired while viewing calibration sources; averaging of calibration instrumentation data such as source temperature measurements; and data compression.

3.1.3.2.5 OPERATIONAL Mode

SRDV3.1.3.2.5-1

The OPERATIONAL mode shall have the following two submodes, at a minimum:

DAYTIME Mode: Normal daytime operating mode, observing in all bands except the low-light visible band.

NIGHTTIME Mode: Normal nighttime operating mode, observing in the low-light visible band and in the emission-dominated infrared bands. In this mode, the reflection-dominated bands, such as the ocean color bands, could be turned off.

In addition, the OPERATIONAL mode should have the following submode:

TERMINATOR Mode: A combined operating mode where the scene contains both day and night information.

SRDV3.1.3.2.5-2

In the OPERATIONAL mode the VIIRS shall generate the following four data streams (TBR):

(1) Regional (high resolution) stored data
(2) Regional (high resolution) real-time data
(3) Global (medium resolution) stored data
(4) Global (medium resolution) real-time data

Regional imagery (Sec. 3.2.1.1.1.1) is incorporated into the regional real-time and stored data streams.

Global imagery (Sec. 3.2.1.1.1.1) is incorporated into the global real-time and stored data streams.

The allocation of other data generated by the VIIRS into these data streams is TBD.

3.1.3.2.6 CALIBRATION Mode(s)

In the CALIBRATION mode(s), the VIIRS views a calibration source and acquires calibration data only. Collection of Earth scene radiance data is suspended in this mode. In this mode, the functional configuration and/or operation of a VIIRS instrument is modified relative to the OPERATIONAL mode configuration and/or operation. For example, the scan may be modified so that a VIIRS instrument views an external calibration source such as the sun or moon.

3.1.3.2.7 SURVIVAL Mode

The SURVIVAL mode is an emergency off mode. The VIIRS will be commanded into this mode in the event of a spacecraft emergency. The intent is that all instruments on the spacecraft will be reactivated upon spacecraft recovery. Reactivation requires ground intervention.

SRDV3.1.3.2.7-1
Initiation of this mode shall require a minimum of commands. Ideally no instrument reconfiguration is necessary before operating power cut off.

SRDV3.1.3.2.7-2
Thermostatically controlled survival heaters connected to a separate power bus shall be provided, as necessary, to protect the instrument in this mode.

3.1.3.3 Mode Documentation

SRDV3.1.3.3-1
The complete set of VIIRS modes deemed necessary by the contractor shall be defined in the VIIRS A-specification and in the VIIRS ICD.

SRDV3.1.3.3-2
All commands relating to mode configuration and re-configuration shall be defined in the VIIRS A-specification and in the VIIRS ICD.

3.1.4 OPERATIONAL CONCEPT

3.1.4.1 Launch Operations Concept

3.1.4.1.1 **Pre-launch**

The satellite will be transported directly to the launch base where final vehicle preparations and checkout will be accomplished. Final inter-segment and launch system verification tests will be accomplished prior to launch.

3.1.4.1.2 Launch and Injection

During launch and injection to the operational orbit, the various spacecraft subsystems may be powered on or turned off in order to provide protection from the launch and injection environments or to comply with other specified requirements. Spacecraft telemetry to monitor vehicle status will be provided during launch and injection.

Transmission of launch vehicle telemetry may satisfy this requirement during the launch phase. Spacecraft telemetry transmission to ground monitoring stations would be used to the extent practicable during the injection phase. After insertion into its operational orbit and separation from the launch vehicle, appropriate deployments would be initiated by memory command. Early orbit check-out will be conducted at the NPOESS primary SOC in Suitland, MD.

3.1.4.2 On-orbit Operational Concept

The NPOESS satellite will operate in a near circular, sun-synchronous orbit. The nominal orbit for the **satellite** is 833 km altitude, 98.7 (TBR) degrees inclination. The orbit will be a "precise" orbit (i.e., altitude maintained to ± TBD km, nodal crossing times maintained to ± 10 minutes throughout the mission lifetime) to minimize orbital drift (precession). NPOESS must be capable of flying at any equatorial node crossing time. However, the nominal configuration is with the satellite orbits equally spaced, with 0530 and 1330 nodal crossing times for the U.S. Government spacecraft and 2130 for the METOP spacecraft.

The sun Beta angle, β, is the angle between the solar vector (i.e., the **satellite**-sun line) and the orbit plane. For instrument thermal design purposes, the range of β for the NPOESS missions is ± 90 degrees. The satellite will maintain the sun on the appropriate side of the spacecraft to meet the "all beta" requirement.

SRDV3.1.4.**2**-1
Sensor suite design shall allow for approximately a 5 degree infringement of sun on the cold space side of the spacecraft in the case of a noon or midnight orbit.

3.1.4.2.1 On-orbit Tests

The initial on-orbit period is devoted to a complete spacecraft checkout and the calibration and performance verifications of the payload(s). The spacecraft and payload performance verification tests may be repeated at appropriate times during the operational phase of the mission.

3.1.4.2.2 On-orbit Operations

SRDV3.1.4.2.2-1
When the VIIRS is in the OPERATIONAL mode and when the satellite is in the AUTONOMOUS mode (See IRD, Sec. 3.4.2.), the VIIRS shall automatically switch between daytime, nighttime, terminator (if implemented), and routine CALIBRATION modes (if implemented).

SRDV3.1.4.2.2-**2 NOT USED**

SRDV3.1.4.2.2-3
The VIIRS shall be commandable into any operational mode at any time, overriding any pre-programmed modes or earlier commands to switch modes.

SRDV3.1.4.2.2-4
The VIIRS shall be capable of operating for up to 21 days, with a goal of up to 60 days, without commands when the satellite is in the AUTONOMOUS mode. When the satellite is in the AUTONOMOUS mode, the VIIRS should be capable of performing housekeeping tasks without ground contact.
When the satellite is in the AUTONOMOUS mode, sensor anomaly resolution should be provided to the extent possible based on available resources.

3.1.5 MISSIONS

The mission of the VIIRS is to provide high quality imagery and radiometric data within the visible and infrared spectral regions to support worldwide DoD and civilian operations and high-priority programs.

3.2 SENSOR SUITE CHARACTERISTICS

3.2.1 PERFORMANCE CHARACTERISTICS

The data product level requirements of the EDRs supported by the VIIRS drive the performance characteristics of the VIIRS.

SRDV3.2.1-1
Instrument level requirements shall be derived by the contractor based on a flowdown of EDR requirements to instrument performance requirements using the contractor's EDR algorithms.

Performance requirements in the OPERATIONAL mode are provided below.

SRDV3.2.1-2
Performance requirements in other modes shall be recommended by the contractor. Requirements for other modes must be consistent with the functions and purposes of the mode as described above in Section 3.1.3.

3.2.1.1 EDR Requirements

SRDV3.2.1.1-1
The VIIRS design and algorithms shall be adequate to allow the environmental data records listed in Section 3.2.1.1.1 to be met.

SRDV3.2.1.1-2
At a minimum, the VIIRS design and algorithms shall allow the EDR requirements to be satisfied at the threshold level. The generation and delivery of operational EDRs will be the responsibility of the IDPS (TSPR) contractor, not the VIIRS contractor.

3.2.1.1.1 Primary EDRs

SRDV3.2.1.1.1-1
Requirements for the following "primary" EDRs **(with references to sections of the TRD Appendix D in parentheses)** shall be satisfied using sensing data acquired by the VIIRS,

supplemented in some cases by data derived from other (non-VIIRS) sensors, databases, and ancillary sources:

- Imagery (except microwave imagery) (Appendix D, Sec. 40.2.3)
- Sea Surface Temperature (Appendix D, Sec. 40.2.4)
- Soil Moisture (Appendix D, Sec. 40.2.6)
- Aerosol Optical Thickness (Appendix D, Sec. 40.3.1.1)
- Aerosol Particle Size Parameter (Appendix D, Sec. 40.3.1.2)
- Suspended Matter (Appendix D, Sec. 40.3.1.3)
- Cloud Base Height (Derived) (Appendix D, Sec. 40.4.1)
- Cloud Cover/Layers (Appendix D, Sec. 40.4.2)
- Cloud Effective Particle Size (Appendix D, Sec. 40.4.3)
- Cloud Optical Thickness (Appendix D, Sec. 40.4.6)
- Cloud Top Height (Derived) (Appendix D, Sec. 40.4.7)
- Cloud Top Pressure (Derived) (Appendix D, Sec. 40.4.8)
- Cloud Top Temperature (Appendix D, Sec. 40.4.9)
- Albedo (Surface) (Appendix D, Sec. 40.5.2)
- Land Surface Temperature (Appendix D, Sec. 40.6.1)
- Normalized Differential Vegetative Index (Appendix D, Sec. 40.6.2)
- Snow Cover/Depth (Appendix D, Sec. 40.6.3)
- Vegetation **Index**/Surface Type (Appendix D, Sec. 40.6.4)
- Ocean Currents (Near Shore/Surface) (Appendix D, Sec. 40.7.1)
- Fresh Water Ice (Appendix D, Sec. 40.7.2)
- Ice Surface Temperature (Appendix D, Sec. 40.7.3)
- Littoral Sediment Transport (Appendix D, Sec. 40.7.4)
- Net Heat Flux (Appendix D, Sec. 40.7.5)
- Ocean Color/Chlorophyll (Appendix D, Sec. 40.7.6)
- Sea Ice Age/Edge Motion (Appendix D, Sec. 40.7.8)
- Mass Loading (IORD Name: Turbidity) (Appendix D, Sec. 40.7.11)

SRDV3.2.1.1.1-2
If data from another non-VIIRS sensor are required to meet a threshold for any of these EDRs, the VIIRS contractor shall identify the data content, quality, and timeliness required from the other sensor. The government may impose modified requirements on the VIIRS if:

a) It becomes evident that data having the required content, quality, and timeliness will not be available from the other sensor, or

b) **T**he VIIRS does not provide data having the content, quality, and timeliness required by another sensor to meet the other sensor's primary EDR requirements.

Any requirement modifications will be at the government's discretion, following technical interchange and coordination with the affected contractors. These modified requirements may be imposed on the VIIRS, the other sensor, or both. The other sensor need not be one addressed in this procurement.

SRDV3.2.1.1.1-3
Regardless of whether or not data are required from a non-VIIRS sensor, the VIIRS contractor shall be responsible for ensuring that the thresholds for the EDRs listed in this section are satisfied.

The VIIRS is referred to as the "primary" sensor suite or data source for the EDRs listed in this section, and these EDRs are referred to as the "primary" EDRs for the VIIRS.

Requirements for each of the primary EDRs are listed below and also in **the TRD** Appendix D. These requirements include maximum local average revisit time and maximum local refresh. These are system requirements and are to be met with a three ball system at 833 km altitude. The sensor contractor is not responsible for these system requirements. The sensor contractor is responsible for providing a sensor suite that has a swath width which will allow the system refresh and revisit requirements to be met when the sensor suite is flown on each of the three satellites in the system. The refresh and revisit times do, however, provide upper bounds on the time available for performing measurements between the generation of successive EDRs. These upper bounds are to be taken into account by the sensor contractor in formulating algorithms for the primary EDRs.

In the tables below, only attributes that are numbered in the "Paragraph Number" column are VIIRS requirements. Attributes that are not numbered are provided for information only.

SRDV3.2.1.1.1-4
In addition to the explicit requirements given in Section 3.2.1.1.1 for each primary EDR, there may be derived EDR requirements associated with the satisfaction of thresholds for one or more other EDRs. If a derived requirement conflicts with an explicit requirement and/or another derived requirement, the most stringent requirement shall be satisfied.

Unless otherwise specified, attribute values are to be interpreted as upper bounds anywhere in the geographical area where measurements are obtained, including the edge of the measuring sensor field of regard. A threshold or objective is "met" or "satisfied" if the system performance value is less than or equal to the specified value. **Examples of exceptions to this rule are *Measurement Range* and *Minimum Swath Width* requirements.**

Unless otherwise specified, a percentage appearing as a value for an attribute is to be interpreted as the percentage of the true value of the attribute. For any attribute where a percentage and a numerical value are specified, the greater of the two is the requirement.

Vertical height is measured either by atmospheric pressure or by height above the Earth's surface. A value of zero km for height refers to the Earth's surface. Negative values of height refer to depth below the Earth's surface (land or water).

Specification of horizontal cell size or horizontal spatial resolution at nadir does not imply that data must be acquired from a cross-track scanning sensor. The data may be acquired from a conically scanning sensor or any other sensor as long as the horizontal cell size or resolution along the satellite ground track does not exceed the nadir upper bound. For an EDR for which horizontal cell size is specified only at nadir, cell size is allowed to grow away from nadir as a normal function of the look angle.

SRDV3.2.1.1.1-5
The contractor shall specify the conditions under which the requirement to deliver an EDR meeting data content and quality requirements will not be met, regardless of whether conditions are clear or cloudy.

SRDV3.2.1.1.1-6
The contractor shall also specify the conditions under which it would recommend delivering an EDR which is incomplete and/or of degraded quality but which is still of potential utility to one or more users.

3.2.1.1.1.1 Imagery

Imagery requirements fall into three classes: (a) explicit requirements on the EDR content, quality, reporting frequency, and timeliness; (b) requirements to be derived based on specific applications utilizing the imagery EDR, such as manual generation of cloud and sea ice data; and (c) requirements to be derived by the contractor based on requirements for other EDRs supported by the imagery. The explicit and application-related requirements are specified below. (Automated generation of cloud data is addressed in other EDRs and, therefore, will not be addressed below.)

3.2.1.1.1.1.1 Explicit EDR Requirements

Imagery is defined as the measured, locally-averaged upwelling radiance or equivalent blackbody temperature from the Earth's surface and atmosphere in one or more spectral bands, where the local averages are reported for the points of a two-dimensional, approximately rectangular lattice. (The lattice is only approximately rectangular because of the curvature of the Earth.) The form of the weighting function that determines the local average is constrained by the horizontal spatial resolution requirement. The number of spectral bands, band limit values, measurement ranges, and measurement uncertainty requirements are to be derived, based on the application-related requirements given below and on the requirements of other EDRs supported by the imagery. However, at least one daytime visible, one nighttime visible, and at least one IR channel are required.

SRDV3.2.1.1.1.1.1-1
Daytime and nighttime visible imagery shall be merged so as to minimize the apparent transition across the terminator. This requirement is in addition to the requirements to perform absolute radiometry in the visible bands entailed by the EDR requirements.

Unless otherwise specified, the explicit EDR requirements below apply to each spectral band that is required for the Application-Related requirements of Section 3.2.1.1.1.2 and, at a minimum, to at least one daytime visible, one nighttime visible, and one IR channel (TBR).

Units: Dimensionless

Para. No.		Thresholds	Objectives
	a. Horizontal Spatial Resolution (HSR)		
V40.2.3.1-2	1. Global, at nadir	1.0 km	(TBD)
V40.2.3.1-3	2. Global, worst case	2.4 km	0.65 km
V40.2.3.1-4	3. Regional, at nadir	0.4 km	(TBD)
V40.2.3.1-5	4. Regional, worst case	0.8 km	0.1 km
V40.2.3.1-6	5. Nighttime Visible, worst case	2.6 km	0.65 km
V40.2.3.1-7	b. Horizontal Reporting Interval	Less than or equal to actual HSR (gapless or near gapless coverage)	Less than or equal to actual HSR (gapless or near gapless coverage)
	c. Horizontal Coverage		
V40.2.3.1-8	1. Global (stored and real-time)	Global	Global
V40.2.3.1-9	2. Regional, stored	Up to 1/2 orbit, non-contiguous, commandable by SOC	Up to 1/2 orbit, non-contiguous, commandable by SOC
V40.2.3.1-10	3. Regional, real-time	Global	Global
	d. Measurement Range		
V40.2.3.1-11	1. Nighttime visible	4E-9 - 7E-4 W/cm^2-sr in 0.4-1.0 mm band, or equivalent in another band	Includes threshold range
V40.2.3.1-12	2. Other bands	Derived	Derived
V40.2.3.1-13	e. Measurement Uncertainty	Derived	Derived
	f. Mapping Uncertainty		
V40.2.3.1-14	1. At nadir	3 km	(TBD)
V40.2.3.1-15	2. Worst case	4 km	0.5 km
	g. Maximum Local Average Revisit Time	4 hrs	(TBD)
	h. Maximum Local Refresh	6 hrs	(TBD)
	i. Fraction of Revisit Times Less Than a Specified Value	At any location at least 75% of the revisit times will be 4 hours or less.	(TBD)
V40.2.3.1-16	Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.1.2 Application-Related Requirements (TBR)

The content and quality of the imagery shall be adequate to allow the following application-related requirements to be met. These requirements, together with requirements of other EDRs supported by the imagery, determine the derived requirements in the explicit EDR requirement set above and may drive specified values of non-derived attributes to more stringent values. The content of the application-related data products is not part of the content of the imagery EDR. It is assumed that flowdown of application-related requirements to explicit imagery requirements will be performed by contractor simulation and modeling.

Manually Generated Cloud Data

Manually generated cloud data are estimates of cloud cover and cloud type generated by a trained human analyst viewing the unprocessed and/or processed imagery derived from the unprocessed imagery, e.g., by data fusion, spatial rescaling, image enhancement, etc.

3.2.1.1.1.1.3 Cloud Cover

Cloud cover is defined as the fraction of a given area, i.e., of a horizontal cell, on the Earth's surface for which a locally normal line segment, extending between two given altitudes, intersects a detectable cloud as defined in the Glossary. For manual analyses, cloud cover is estimated for a single atmospheric layer. Specifically, the minimum and maximum altitudes of this layer are defined to be the surface of the Earth and the altitude where the pressure is 0.1 mb. Haze, smoke, dust, and rain are not to be considered clouds. For the purpose of validating this requirement, cloud cover estimates are to be generated by a trained human analyst viewing unprocessed and/or processed imagery for contiguous square areas having side length equal to the horizontal cell size specified below.

Units: Dimensionless

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.2.3.2-1	1. Global	3 (TBR) times global HSR	2 times global HSR
V40.2.3.2-2	2. Regional	3 (TBR) times regional HSR	2 times regional HSR
V40.2.3.2-3	b. Horizontal Reporting Interval	Horizontal cell size	Horizontal cell size
V40.2.3.2-4	c. Measurement Range	0 - 1, 0.1 increments	0 - 1, 0.1 increments
V40.2.3.2-5	d. Measurement Uncertainty	0.1	0.1

3.2.1.1.1.1.4 Cloud Type

Cloud types are defined as follows:

(1) Altocumulus (AC)
(2) Altocumulus Castellanus (ACCAS)
(3) Altocumulus (Standing lenticular) (ACSL)
(4) Altostratus (AS)
(5) Cirrocumulus (CC)
(6) Cirrocumulus (Standing lenticular) (CCSL)
(7) Cirrostratus (CS)
(8) Cirrus (CI)
(9) Cumulonimbus (CB)
(10) Cumulonimbus mama (Mammatocumulus) (CBMAM)
(11) Cumulus (CU)
(12) Cumulus Fractus (CUFRA)
(13) Towering Cumulus (TCU)
(14) Stratus Fractus (STFRA)
(15) Nimbostratus (NS)
(16) Stratocumulus (SC)
(17) Stratocumulus (Standing lenticular) (SCSL)
(18) Stratus (ST)

Cloud typing not only entails a capability to distinguish between clouds of different type, but also a capability to distinguish clouds from other features, such as snow, cold water, cold land, haze, smoke, dust, etc. Therefore, the following additional types are defined:

(19) Obscured/not cloudy
(20) Clear

A given area is classified (TBR) as "obscured/not cloudy" if there are no detectable clouds within the atmosphere overlying the area and if the average vertical LOS extinction optical thickness of the atmosphere overlying the area is ≥ 0.03 (TBR) in the 0.4-0.7 μm band (TBR). A given area is classified (TBR) as "clear" if there are no detectable clouds, as defined above, overlying the area and if the average vertical LOS extinction optical thickness of the atmosphere overlying the area is < 0.03 (TBR)) in the 0.4-0.7 μm band (TBR). Note that other EDRs require the type of non-cloud obscuration to be discerned and identified, e.g., smoke, dust, sand, ash, etc.

For the purpose of validating this requirement, typing is to be performed by a trained human analyst viewing unprocessed and/or processed imagery for contiguous square areas having side length equal to the horizontal cell size specified below. The probability of correct typing is defined as the probability that a cell reported as being of type x is in fact of type x, where x is any of the types specified above.

Units: N/A

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.2.3.2.1.2-1	1. Global	(TBD) times global HSR	2 times global HSR
V40.2.3.2.1.2-2	2. Regional	(TBD) times regional HSR	2 times regional HSR
V40.2.3.2.1.2-3	b. Horizontal Reporting Interval	Horizontal cell size	Horizontal cell size
V40.2.3.2.1.2-4	c. Measurement Range	Clear, obscured/not cloudy, ST, CU, CI	Clear, obscured/not cloudy, all 18 cloud types
	d. Probability of Correct Typing		
V40.2.3.2.1.2-5	1. Global	85 %	90 %
V40.2.3.2.1.2-6	2. Regional	85 %	90 %

Sea Ice Data

Sea ice data may be generated interactively by a trained human analyst viewing unprocessed or processed imagery at a computer workstation, or automatically via an algorithm. In addition to determination of ice edge location and ice concentration as described below, analysts will attempt to determine the thickness and size of leads and polynyas based on the imagery.

3.2.1.1.1.1.5 Ice Edge Location

An ice edge is defined as the boundary between ice-covered sea water (ice concentration > 0.1 (TBR)) and sea water not covered by ice (ice concentration ≤ 0.1 (TBR)). Ice concentration is defined as the fraction of a given area **of** sea water covered by ice. An ice edge is typically provided as a contour on a map or in digital form as a set of latitude/longitude coordinates. The ice edge location error is defined as the distance between the estimated location of an ice edge and the nearest location of a true ice edge.

Units: Degrees latitude and longitude

Para. No		Thresholds	Objectives
V40.2.3.2.2.1-1	a. Horizontal Coverage	North of 36 deg north latitude, south of 50 deg south latitude for sea ice.	North of 36 deg north latitude, south of 50 deg south latitude for sea ice.
V40.2.3.2.2.1-2	b. Measurement Range	Any latitude, longitude within coverage domain	Any latitude, longitude within coverage domain
	c. Measurement Uncertainty		
V40.2.3.2.2.1-3	1. Global/Clear	(TBD)	(TBD)
V40.2.3.2.2.1-4	2. Global/Cloudy	(TBD)	(TBD)
V40.2.3.2.2.1-5	3. Regional/Clear	(TBD)	(TBD)
V40.2.3.2.2.1-6	4. Regional/Cloudy	(TBD)	(TBD)

3.2.1.1.1.1.6 Ice Concentration

Ice concentration is defined as the fraction of a given area of sea water covered by ice. It is typically derived from imagery and reported on ocean geographical charts for areas between contours generated by an analyst. For the purpose of verifying the measurement uncertainty requirement, the true value of the ice concentration in an area within the contours generated by the analyst is to be compared with the estimated value of ice concentration in this area. Errors in generating boundaries between regions having different ice concentrations (to the nearest 1/10) are ignored for the purpose of validating this requirement.

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.2.3.2.2.2-1	a. Horizontal Coverage	North of 36 (TBR) deg north latitude, south of 50 deg south latitude for sea ice	North of 36 deg north latitude, south of 50 deg south latitude for sea ice
V40.2.3.2.2.2-2	b. Measurement Range	0 - 1, 0.1 increments	0 - 1, 0.1 increments
V40.2.3.2.2.2-3	c. Measurement Uncertainty	0.1	0.1

3.2.1.1.1.2 Sea Surface Temperature (SST)

Sea surface temperature (SST) is defined as the skin temperature of the ocean surface water. The measured radiances should enable the derivation of both skin and surface layer (1 meter depth) sea surface temperature to the specifications listed below, though an EDR algorithm is only required for skin temperature. The requirements below apply only under clear conditions.

Units: K

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.2.4-1	1. Global, at nadir	3 km	1 km
V40.2.4-2	2. Global, worst case	4 km	(TBD)
V40.2.4-3	3. Regional, at nadir	1 km	0.25 km
V40.2.4-4	4. Regional, worst case	1.3 km	(TBD)
V40.2.4-5	b. Horizontal Reporting Interval	Local Horizontal Cell Size	Local Horizontal Cell Size
	c. Horizontal Coverage		
V40.2.4-6	1. Global	Oceans	Oceans
V40.2.4-7	2. Regional	Oceans, up to 1/2 orbit, non-contiguous, commandable by SOC	Oceans, up to 1/2 orbit, non-contiguous, commandable by SOC
V40.2.4-8	d. Measurement Range	271 K - 313 K	271 K - 313 K
V40.2.4-9	e. Measurement Uncertainty (TBR)	0.5 K (TBR)	0.1 K
V40.2.4-10	f. Measurement Accuracy	0.2 K	0.1 K
V40.2.4-11	g. Measurement Precision	(TBD)	0.1 K
	h. Mapping Uncertainty		
V40.2.4-12	1. Global, at nadir	1 km	0.5 km
V40.2.4-13	2. Global, worst case	3 km	(TBD)
V40.2.4-14	3. Regional, at nadir	1 km	0.1 km
V40.2.4-15	4. Regional, worst case	3 km	(TBD)
	i. Maximum Local Average Revisit Time	6 hrs	3 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.2.4-16	k. Minimum Swath Width	1700 km (TBR)	(TBR)

3.2.1.1.1.3 Soil Moisture

Total water in all phases in the soil or in a surface layer over soil. The threshold requirement is to measure soil moisture only within a thin layer at the surface (0.1 cm thick) and only for bare soil in regions with known soil types. The objective is to measure a moisture profile for any soil, whether bare or not, and whether or not the soil type is known.

Units: cm/m (cm of water per meter of soil depth)

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.2.6-1	1. Clear, at nadir (TBR)	1 km	(TBD)
V40.2.6-2	2. Clear, worst case (TBR)	4 km	2 km
	3. Cloudy, at nadir	40 km	2 km
	4. Cloudy, worst case	50 km	(TBD)
V40.2.6-3	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.2.6-4	c. Vertical Cell Size	0.1 cm	5 cm
V40.2.6-5	d. Vertical Reporting Interval	N/A (single value reported)	5 cm
V40.2.6-6	e. Horizontal Coverage	Land	Land
V40.2.6-7	f. Vertical Coverage (TBR)	Surface to -0.1 cm (skin layer)	Surface to -80 cm
V40.2.6-8	g. Measurement Range	0 - 100 cm/m (TBR)	0 - 100 cm/m
	h. Measurement Uncertainty		
V40.2.6-9	1. Clear, Bare soil in regions with known soil types (smaller horizontal cell size)	10 cm/m (TBR)	Surface: 1 cm/m Total 80 cm column: greater of 5 % or 0.013 cm/m (130 gm/m^3)
	2. Cloudy , Bare soil in regions with known soil types (greater horizontal cell size)	20 cm/m (TBR)	Surface: 1 cm/m Total 80 cm column: greater of 5 % or 0.013 cm/m (130 gm/m^3)
V40.2.6-10	i. Mapping Uncertainty	3 km	1 km
	j. Maximum Local Average Revisit Time	8 hrs	3 hrs
	k. Maximum Local Refresh	(TBD)	(TBD)
V40.2.6-11	l. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**4** Aerosols

Aerosols are defined as suspensions of liquid droplets or solid particles in the atmosphere. Aerosols include, but are not limited to, smoke, dust, sand, volcanic ash, sea spray, polar stratospheric clouds, and smog. Water and ice clouds are also aerosols, but because of the frequency of their occurrence and their importance to military operations, they are addressed separately in another EDR (See Sec. 40.2.3, Imagery).

3.2.1.1.1.**4**.1 Aerosol Optical Thickness

Aerosol optical thickness, for this EDR, is defined (TBS) as the extinction (scattering + absorption) vertical optical thickness of aerosols in the 0.4 to 1.0 μm band in atmospheric layers of specified height and thickness. The narrow bands used to derive the aerosol particle size parameter may be used to derive aerosol optical thickness in the 0.4 to 1.0 μm band. Optical thickness (τ) is related to transmission (t) by $t = \exp(-\tau)$. The requirements below apply only under clear conditions.

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.3.1.1-1	a. Horizontal Cell Size	10 km	1 km
V40.3.1.1-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.3.1.1-3	c. Vertical Cell Size	30 km (Total Column)	50 km
V40.3.1.1-4	1. 0 - 2 km	N/A	0.25 km
V40.3.1.1-5	2. 2 - 5 km	N/A	0.5 km
V40.3.1.1-6	3. > 5 km	N/A	1 km
V40.3.1.1-7	d. Vertical Reporting Interval	N/A (Total Column)	Vertical cell size
V40.3.1.1-8	e. Horizontal Coverage	Global	Global
V40.3.1.1-9	f. Vertical Coverage	0 - 30 km	0 - 50 km
V40.3.1.1-10	g. Measurement Range	0 - 2	0 - 10
	h. Measurement Accuracy		
V40.3.1.1-11	1. Over Ocean	0.03 (TBR) over ocean	0.01
V40.3.1.1-12	2. Over Land	0.2 (TBR) over land	0.1
V40.3.1.1-13	i. Measurement Precision	0.03	0.01
V40.3.1.1-14	j. Long-term Stability	0.01	0.003
V40.3.1.1-15	k. Mapping Uncertainty	4 km	1 km
	l. Maximum Local Average Revisit Time	6 hrs (TBR)	4 hrs(TBR)
	m. Maximum Local Refresh	(TBD)	(TBD)
V40.3.1.1-16	n. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.4.2 Aerosol Particle Size Parameter

The aerosol particle size parameter, for this EDR, is defined (TBR) as the Angstrom wavelength exponent "alpha" (α), where:

$$\alpha = - \Delta \ln t / \Delta \ln \lambda$$

t is the extinction (scattering + absorption) vertical optical thickness of the aerosols within specified layers of the atmosphere, and λ is wavelength within the visible/infrared spectrum (< 10 μm). Measurements of optical thickness in at least two different narrow wavelength bands are required to measure α, and the "delta" in the above equation refers to the difference between the measurements in these two bands. The two narrow bands should be separated by at least 200 nm in wavelength. If the aerosol particle size distribution is given by an inverse power law, such as a Junge distribution, then alpha can be related to the exponent in the power law. The requirements below apply only under clear conditions.

Units: Dimensionless.

Para. No.		Thresholds	Objectives
V40.3.1.2-1	a. Horizontal Cell Size	10 km	1 km
V40.3.1.2-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.3.1.2-3	c. Vertical Cell Size	30 km (Total Column)	50 km
V40.3.1.2-4	1. 0 - 2 km	N/A	0.25 km
V40.3.1.2-5	2. 2 - 5 km	N/A	0.5 km
V40.3.1.2-6	3. > 5 km	N/A	1 km
V40.3.1.2-7	d. Vertical Reporting Interval	N/A (Total Column)	Vertical cell size
V40.3.1.2-8	e. Horizontal Coverage	Over ocean only	Global
V40.3.1.2-9	f. Vertical Coverage	0 - 30 km	0 - 50 km
V40.3.1.2-10	g. Measurement Range	-1 to +3	-2 to +4
V40.3.1.2-11	h. Measurement Accuracy	0.3 over ocean	0.1
V40.3.1.2-12	i. Measurement Precision	0.3	0.1
V40.3.1.2-13	j. Long-term Stability	0.1	0.03
V40.3.1.2-14	k. Mapping Uncertainty	4 km	1 km
	l. Maximum Local Average Revisit Time	6 hrs	4 hrs(TBR)
	m. Maximum Local Refresh	(TBD)	(TBD)
V40.3.1.2-17	n. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.4.3 Suspended Matter

As a threshold, the required content of this EDR is the identification of specified classes of suspended matter in instances in which suspended matter is detected. There are no explicit detectability requirements for the types of suspended matter of interest. The capability to detect suspended matter, and all other aerosols, will be a by-product of the capabilities required by other EDRs. As a threshold, dust, sand, and ash are to be identified for a vertical column of the atmosphere, if detected. As an objective, these types as well as sea salt, smoke, and radioactive smoke are to be typed in 0.2 km layers within a vertical column of the atmosphere. Furthermore, as an objective, the concentration of the suspended matter, if detected, is also to be provided. The requirements below apply only under clear conditions.

Units:
Typing: N/A
Concentration: $\mu g/m^3$

Para. No.		Thresholds	Objectives
V40.3.1.3-1	a. Horizontal Cell Size	3 km	1 km
V40.3.1.3-2	b. Horizontal Reporting Interval	Local Horizontal Cell Size	Local Horizontal Cell Size
V40.3.1.3-3	c. Vertical Cell Size	30 km (Total Column)	0.2 km
V40.3.1.3-4	d. Vertical Reporting Interval	N/A	Vertical Cell Size
V40.3.1.3-5	e. Horizontal Coverage	Global	Global
V40.3.1.3-6	f. Vertical Coverage	0 - 30 km	(TBD)
	g. Measurement Range		
V40.3.1.3-7	1. Type	Dust, sand, ash, other	Dust, sand, ash, sea salt, smoke, radioactive smoke, other
V40.3.1.3-8	2. Concentration	N/A	0 - 100 $\mu g/m^3$ (smoke)
V40.3.1.3-9	h. Probability of Correct Typing	(TBD)	(TBD)
V40.3.1.3-10	i. Measurement Uncertainty (concentration)	N/A	(TBD)
V40.3.1.3-11	j. Mapping Uncertainty	3 km	0.1 km
	k. Maximum Local Average Revisit Time	12 hrs	3 hrs
	l. Maximum Local Refresh	(TBD)	(TBD)
V40.3.1.3-12	m. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.5 Cloud Base Height

Cloud base height is defined as the height above ground level where cloud bases occur. More precisely, for a cloud covered Earth location, cloud base height is the set of altitudes of the bases of the clouds that intersect the local vertical at this location. The reported heights are horizontal spatial averages over a cell, i.e., a square region of the Earth's surface. If a cloud layer does not extend over an entire cell, the spatial average is limited to the portion of the cell that is covered by the layer. As a threshold, only the height of the base of the lowest altitude cloud layer is required and the objective is to report cloud base height for all distinct cloud layers.

Units: km

Para. No.		Thresholds	Objectives
V40.4.1-1	a. Horizontal Cell Size	25 km	10 km
V40.4.1-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.1-3	c. Horizontal Coverage	Global	Global
	d. Vertical Cell Size	N/A	N/A
V40.4.1-4	e. Vertical Reporting Interval	Total Column	0.25 km
V40.4.1-5	f. Measurement Range	0 - 15 km	0 - 30 km
V40.4.1-6	g. Measurement Uncertainty	2 km (TBR)	0.25 km
V40.4.1-7	h. Mapping Uncertainty	4 km	1 km
	i. Maximum Local Average Revisit Time	6 hrs	4 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.4.1-8	I. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**6** Cloud Cover/Layers

Cloud cover is defined (TBR) as the fraction of a given area on the Earth's surface for which a locally normal line segment extending between two given altitudes intersects a cloud. As a threshold, cloud cover is required for up to four layers of the atmosphere between the surface and an altitude of 30 km. As an objective, cloud cover is required for contiguous, 0.1 km thick layers at 0.1 km increments in altitude, from the surface of the Earth to an altitude of 30 km.

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.4.2-1	a. Horizontal Cell Size	25 km	2 km
V40.4.2-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
	c. Vertical Cell Size	N/A	N/A
V40.4.2-3	d. Vertical Reporting Interval	Up to 4 layers	0.1 km
V40.4.2-4	e. Horizontal Coverage	Global	Global
V40.4.2-5	f. Vertical Coverage	0 - 20 km	0 - 30 km
V40.4.2-6	g. Measurement Range	0 - 1.0	0 - 1.0
V40.4.2-7	h. Measurement Accuracy	0.1	0.05
V40.4.2-8	i. Measurement Precision	0.15	0.025
V40.4.2-9	j. Mapping Uncertainty	4 km	1 km
	k. Maximum Local Average Revisit Time	6 hrs	4 hrs
	l. Maximum Local Refresh	(TBD)	(TBD)
V40-4.2-10	m. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**7** Cloud Effective Particle Size

Effective cloud particle size is defined as the ratio of the third moment of the drop size distribution to the second moment, averaged over a layer of air within a cloud.

Units: μm

Para. No.		Thresholds	Objectives
V40.4.3-1	a. Horizontal Cell Size	50 km	10 km
V40.4.3-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.3-3	c. Vertical Cell Size	Vertical Reporting Interval	Vertical Reporting Interval
V40.4.3-4	d. Vertical Reporting Interval	1.0 km(TBR)	0.3 km
V40.4.3-5	e. Horizontal Coverage	Global	Global
V40.4.3-6	f. Vertical Coverage	0 - 20 km	0 - 30 km
V40.4.3-7	g. Measurement Range	0 - 50 μm	(TBD)
V40.4.3-8	h. Measurement Accuracy	Greater of 10 % or 4 μm	Greater of 5 % or 2 μm
V40.4.3-9	i. Measurement Precision	Greater of 5 % or 2 μm	2 %
V40.4.3-10	j. Long-term Stability	2 %	1 %
V40.4.3-11	k. Mapping Uncertainty	4 km	1 km
	l. Maximum Local Average Revisit Time	8 hrs	3 hrs
	m. Maximum Local Refresh	(TBD)	(TBD)
V40.4.3-14	n. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**8** Cloud Optical Thickness (IORD Name: Cloud Optical Depth/Transmissivity)

Cloud optical thickness is defined as the extinction (scattering + absorption) vertical optical thickness of all cloud layers in a vertical column of the atmosphere. Optical thickness (τ) is related to transmittance (t) by $t = \exp(-\tau)$. Optical thickness is wavelength dependent and is to be measured in at least two narrow bands centered at 450 nm (TBR) and 850 nm (TBR), with TBD nm bandwidth.

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.4.6-1	a. Horizontal Cell Size	50 km	10 km
V40.4.6-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.6-3	c. Horizontal Coverage	Global	Global
V40.4.6-4	d. Measurement Range	0 - 10 optical depth	(TBD)
V40.4.6-5	e. Measurement Accuracy	Greater of 10 % and 0.05 optical depth	Greater of 5 % and (TBD)
V40.4.6-6	f. Measurement Precision	Greater of 5 % and 0.025 optical depth	Greater of 2 % and (TBD)
V40.4.6-7	g. Long-term Stability	2 %	1 %
V40.4.6-8	h. Mapping Uncertainty	4 km	1 km
	i. Maximum Local Average Revisit Time	8 hrs	3 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.4.6-9	k. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.9 Cloud Top Height

Cloud top height is defined for each cloud-covered Earth location as the set of heights of the tops of the cloud layers overlying the location. The reported heights are horizontal spatial averages over a cell, i.e., a square region of the Earth's surface. If a cloud layer does not extend over an entire cell, the spatial average is limited to the portion of the cell that is covered by the layer. Cloud top height is not defined or reported for cells that are clear. As a threshold, only the height at the top of the highest altitude cloud layer is required. The objective is to report the cloud top height for all distinct cloud layers.

Units: km

Para. No.		Thresholds	Objectives
V40.4.7-1	a. Horizontal Cell Size	25 km	10 km
V40.4.7-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.7-3	c. Horizontal Coverage	Global	Global
	d. Vertical Cell Size	N/A	N/A
V40.4.7-4	e. Vertical Reporting Interval	Up to 4 layers	0.25 km
V40.4.7-5	f. Measurement Range	0 - 20 km	(TBD)
	g. Measurement Accuracy		
V40.4.7-6	1. Cloud layer optical thickness > 0.1(TBR)	1.0 km (TBR)	0.3 km
V40.4.7-7	2. Cloud layer optical thickness ≤ 0.1(TBR)	2 km	0.3 km
V40.4.7-8	h. Measurement Precision	0.3 km	0.15 km
V40.4.7-9	i. Long-term Stability	0.2 km	0.1 km
V40.4.7-10	j. Mapping Uncertainty	4 km	1 km
	k. Maximum Local Average Revisit Time	8 hrs	6 hrs
	l. Maximum Local Refresh	(TBD)	(TBD)
V40.4.7-11	m. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**10** Cloud Top Pressure

Cloud top pressure is defined for each cloud-covered Earth location as the set of atmospheric pressures at the tops of the cloud layers overlying the location. The reported pressures are horizontal spatial averages over a cell, i.e., a square region of the Earth's surface. If a cloud layer does not extend over an entire cell, the spatial average is limited to the portion of the cell that is covered by the layer. Cloud top pressure is not defined or reported for cells that are clear. As a threshold, only the pressure at the top of the highest altitude cloud layer is required. The objective is to report the cloud top pressure for all distinct cloud layers.

Units: mb

Para. No.		Thresholds	Objectives
V40.4.8-1	a. Horizontal Cell Size	15 km	10 km
V40.4.8-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.8-3	c. Horizontal Coverage	Global	Global
V40.4.8-4	d. Measurement Range	50 - 1050 mb	(TBD)
	e. Measurement Accuracy		
V40.4.8-5	1. Surface - 3 km	100 mb	30 mb
V40.4.8-6	2. 3 - 7 km	75 mb	22 mb
V40.4.8-7	3. > 7 km	50 mb	15 mb
	f. Measurement Precision		
V40.4.8-8	1. Surface - 3 km	50 mb	10 mb
V40.4.8-9	2. 3 - 7 km	38 mb	7 mb
V40.4.8-10	3. > 7 km	25 mb	5 mb
	g. Long-term Stability (TBR)		
V40.4.8-11	1. Surface - 3 km	10 mb	3 mb
V40.4.8-12	2. 3 - 7 km	7 mb	2 mb
V40.4.8-13	3. > 7 km	5 mb	1 mb
V40.4.8-14	h. Mapping Uncertainty	4 km	1 km
	i. Maximum Local Average Revisit Time	8 hrs	3 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.4.8-15	i. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.**11** Cloud Top Temperature

Cloud top temperature is defined for each cloud-covered Earth location as the set of atmospheric temperatures at the tops of the cloud layers overlying the location. The reported temperatures are horizontal spatial averages over a cell, i.e., a square region of the Earth's surface. If a cloud layer does not extend over an entire cell, the spatial average is limited to the portion of the cell that is covered by the layer. Cloud top temperature is not defined or reported for cells that are clear. As a threshold, only the temperature at the top of the highest altitude cloud layer is required. The objective is to report the cloud top temperature for all distinct cloud layers.

Units: K

Para. No.		Thresholds	Objectives
V40.4.9-1	a. Horizontal Cell Size	25 km	10 km
V40.4.9-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.4.9-3	c. Horizontal Coverage	Global	Global
V40.4.9-4	d. Measurement Range	180 - 310 K	(TBD)
	e. Measurement Accuracy		
V40.4.9-5	1. Cloud layer optical thickness > 0.1 (TBR)	3 K	1.5 K
V40.4.9-6	2. Cloud layer optical thickness ≤ 0.1 (TBR)	6 K	(TBD)
V40.4.9-7	f. Measurement Precision	1.5 K	0.5 K
V40.4.9-8	g. Long-term Stability	1 K	0.1 K
V40.4.9-9	h. Mapping Uncertainty	4 km	1 km
	i. Maximum Local Average Revisit Time	6 hrs	6 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.4.9-12	k. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.12 Albedo (Surface)

Surface albedo is defined as the amount of solar radiation reflected by the Earth's surface into an upward hemisphere (sky dome) divided by the amount incident from this hemisphere.(TBR) This EDR is required during daytime only and under clear conditions only. This is an instantaneous, not a time-averaged, measurement. (TBR)

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.5.2-1	a. Horizontal Cell Size	4 km	0.5 km
V40.5.2-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.5.2-3	c. Horizontal Coverage	Global	Global
V40.5.2-4	d. Measurement Range	0 - 1.0	0 - 1.0
V40.5.2-5	e. Measurement Accuracy	0.05	0.0125
V40.5.2-6	f. Measurement Precision	0.02	0.01
V40.5.2-7	g. Long-term Stability	0.02	0.01
V40.5.2-8	h. Mapping Uncertainty	4 km	1.0 km
	i. Maximum Local Average Revisit Time	24 hrs	4 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.5.2-9	k. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.1**3** Land Surface Temperature

Land surface temperature (LST) is defined as the skin temperature of the uppermost layer of the land surface. This EDR is required under clear conditions only.

Units: K

Para. No.		Thresholds	Objectives
V40.6.1-1	a. Horizontal Cell Size	4 km	1 km
V40.6.1-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.6.1-3	c. Horizontal Coverage	Land	Land
V40.6.1-4	d. Measurement Range	213 K - 343 K	213 K - 343 K
V40.6.1-5	e. Measurement Accuracy	2.5 K	1 K
V40.6.1-6	f. Measurement Precision	0.5 K	0.025 K
V40.6.1-7	g. Mapping Uncertainty	4 km	1 km
	h. Maximum Local Average Revisit Time	6 hrs	3 hrs
	i. Maximum Local Refresh	(TBD)	(TBD)
V40.6.1-8	j. Minimum Swath Width	1700 km (TBR)	(TBR)

3.2.1.1.1.1**4** Normalized Difference Vegetation Index (NDVI) (TBR)

Normalized difference vegetation index is most directly related to absorption of photosynthetically active radiation, but is often correlated with biomass or primary productivity. Red spectral measurements are sensitive to the chlorophyll content of vegetation and the near IR to the mesophyll structure of leaves. The normalized ratio (IR - Red)/(IR + Red) has a close relationship with the photosynthetic capacity of specific vegetation types. The NASA/NOAA NDVI (for AVHRR-3) is defined as follows:

NDVI = RATIO of [(Reflectance band 2 - Reflectance band 1)/ sum],
where: Band 2 = NIR band (0.72-1.0 microns);
Band 1 = VIS band (0.572-0.703 microns).

These specific spectral ranges are not required. The requirements below apply only under clear conditions.

Units: Dimensionless

Para. No.		Thresholds	Objectives
V40.6.2-1	a. Horizontal Cell Size	4 km	1 km
V40.6.2-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.6.2-3	c. Horizontal Coverage	Land	(TBD)
V40.6.2-4	d. Measurement Range	-1 to +1 NDVI units	-1 to +1 **NDVI units**
V40.6.2-5	e. Measurement Accuracy	0.05 NDVI units	0.03 NDVI units
V40.6.2-6	f. Measurement Precision	0.04 NDVI units	0.02 NDVI units
V40.6.2-7	g. Long-**term** Stability	0.04 NDVI units	0.04 NDVI units
V40.6.2-8	h. Mapping Uncertainty	4 km	1 km
	i. Maximum Local Average Revisit Time	24 hrs	24 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.6.2-9	k. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.1**5** Snow Cover/Depth

Horizontal and vertical extent of snow cover. As a threshold, only fraction of snow cover in the specified horizontal cell (clear or cloudy) is required, regardless of depth. As an objective, fraction of snow cover for snow having a specified minimum depth is required in the specified horizontal cell (clear or cloudy) for a set of specified minimum depths.

Units: Cover: Fraction
Depth: cm

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size (TBR)		
V40.6.3-1	1. Clear - daytime	1.3 km	1 km
	2. Cloudy and/or nighttime	12.5 km	1 km
V40.6.3-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.6.3-3	c. Snow Depth Ranges	> 0 cm (Any Snow Thickness)	> 8 cm, > 15 cm, > 30 cm, >51 cm, >76 cm
V40.6.3-4	d. Horizontal Coverage	Land	Land & Ice
V40.6.3-5	e. Vertical Coverage	0 - 40 cm	0 - 1 m
V40.6.3-6	f. Measurement Range	0 - 1	0 - 1 per snow depth category
	g. Measurement Uncertainty(TBR)		
V40.6.3-7	1. Clear - daytime	10 % (snow/no snow)	10 % for snow depth
V40.6.3-8	2. Cloudy and/or nighttime	20 % (snow/no snow)	TBD
	h. Mapping Uncertainty		
V40.6.3-9	1. Clear	2 km	1 km
	2. Cloudy	7 km	1 km
	i. Maximum Local Average Revisit Time	12 hrs	3 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.6.3-10	m. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.16 Vegetation Index/Surface Type

Vegetation index/surface type is defined as the predominant vegetation and/or soil type in a given area.
Each given area shall be classified as one of the following 21 types: crop land, brush/scrub, coniferous forest, deciduous forest, tropical forest, grassland, swamp, marsh/bog, flooded land, loam, sandy soil, clay, peat, gravel, desert, water, snow/ice, urban/developed, rocky fields, tundra, and savannah. Estimation of the percentage of vegetation cover per type in each cell is an objective. The requirements below apply under clear conditions **only**.

Units:
Type: N/A
Vegetation Cover: Per cent

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.6.4-1	1. Global	20 km	1 km
V40.6.4-2	2. Regional	20 km	0.25 km
V40.6.4-3	b. Horizontal Reporting Interval	(TBD)	(TBD)
	c. Horizontal Coverage		
V40.6.4-4	1. Global	Land	Land
V40.6.4-5	2. Regional	Land, up to 1/2 orbit, non-contiguous, commandable by SOC	Land, up to 1/2 orbit, non-contiguous, commandable by SOC
	d. Measurement Range		
V40.6.4-6	1. Vegetation/surface type	21 types specified above	21 types specified above
V40.6.4-7	2. Vegetation cover	N/A	0 - 100 %
V40.6.4-8	e. Measurement Accuracy (veg. cover)	N/A	2 %
V40.6.4-9	f. Measurement Precision (veg. cover)	N/A	0.1 %
V40.6.4-10	g. Correct Typing Probability (vegetation /surface type)	70 %	(TBD)
V40.6.4-11	h. Mapping Uncertainty	5 km	1 km
	i. Maximum Local Average Revisit Time	24 hrs	3 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.6.4-12	k. Minimum Swath Width	3000 km (TBR)	(TBR)

3.2.1.1.1.17 Currents

Ocean currents are defined as large-scale movements of the surface and near-surface waters of the ocean driven by wind and the distribution of water density. Currents are described by a local vector field specifying water speed and direction at each point. "Coastal" is defined to be within 370 km of the coastline. The requirements below apply only under clear conditions.

Units:
Speed: m/s
Direction: Deg from north

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.7.1-1	1. Global	4 km	1 km
V40.7.1-2	2. Regional (Coastal)	1.3 km	0.25 km
V40.7.1-3	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.1-4	c. Vertical Cell Size (TBR)	5 m	1 m
V40.7.1-5	d. Vertical Reporting Interval	Vertical Cell Size	Vertical Cell Size
	e. Horizontal Coverage	Oceans	Oceans
V40.7.1-6	1. Global	Oceans, > 370 km from coastline	Oceans, > 370 km from coastline
V40.7.1-7	2. Regional (Coastal)	Oceans, ≤ 370 km from coastline	Oceans, ≤ 370 km from coastline
V40.7.1-8	f. Vertical Coverage	0 to -10 m	0 to -30 m
	g. Measurement Range		
V40.7.1-9	1. Speed	0 - 5 m/s	0 - 5 m/s
V40.7.1-10	2. Direction	0 - 360 deg	0 - 360 deg
	h. Measurement Accuracy (TBR)		
V40.7.1-11	1. Speed	0.25 m/s	0.1 m/s
V40.7.1-12	2. Direction	15 deg	5 deg
	i. Measurement Precision (TBR)		
V40.7.1-13	1. Speed	0.25 m/s	0.1 m/s
V40.7.1-14	2. Direction	15 deg	5 deg
V40.7.1-15	j. Mapping Uncertainty	3 km	1 km
	k. Maximum Local Average Revisit Time	(TBD)	12 hrs
	l. Maximum Local Refresh	(TBD)	(TBD)
V40.7.1-16	m. Minimum Swath Width	1700 km (TBR)	(TBD)

3.2.1.1.1.1**8** Fresh Water Ice

Fresh water ice concentration is defined as the fraction of a given area of fresh water that is covered by ice, quantized to the nearest one tenth. Ice edge boundary is the contour separating fresh water from fresh water ice. The error in ice edge boundary location is defined as the distance between a measured boundary point and the nearest point on the true ice edge boundary. The measurement uncertainty requirement on ice edge boundary limits this error. Ice edge concentration and boundaries are derived from the Imagery EDR. The requirements below apply only under clear conditions.

Units:
Concentration: Dimensionless
Ice Edge Boundary: lat/long

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.7.2-1	1. Regional, nadir	4 times 0.4 km (TBR)	(TBD)
V40.7.2-2	2. Regional, worst case	4 times 0.8 km (TBR)	0.65 km
V40.7.2-3	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.2-4	c. Horizontal Coverage	Fresh Water Up to 1/2 orbit, non-contiguous, commandable by SOC	Fresh Water Up to 1/2 orbit, non-contiguous, commandable by SOC
V40.7.2-5	d. Measurement Range	1/10 to 10/10 concentration	0/10 to 10/10 concentration
	e. Measurement Uncertainty		
V40.7.2-6	1. Ice Edge Boundary(TBS)	10 km	5 km
V40.7.2-7	2. Ice Concentration	20 % or 1/10	10 %
V40.7.2-8	f. Mapping Uncertainty	3 km	1 km
	g. Maximum Local Average Revisit Time	12 hrs	6 hrs
	h. Maximum Local Refresh	(TBD)	(TBD)
V40.7.2-9	i. Minimum Swath Width	3000 km(TBR)	(TBD)

3.2.1.1.1.19 Ice Surface Temperature

As a threshold, the temperature of the surface of ice over land or water is required. The objective is to measure the atmospheric temperature 2 m above the surface of the ice. This EDR is required under clear conditions only.

Units: K

Para. No.		Thresholds	Objectives
V40.7.3-1	a. Horizontal Cell Size	30 km	10 km
V40.7.3-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.3-3	c. Horizontal Coverage	Ice-covered land/water	Ice-covered land/water
V40.7.3-4	d. Measurement Range	213 K - 293 K	(TBD)
V40.7.3-5	e. Measurement Uncertainty	1 K	(TBD)
V40.7.3-6	f. Mapping Uncertainty	3 km	1 km
	g. Maximum Local Average Revisit Time	24 hrs	12 hrs
	h. Maximum Local Refresh	(TBD)	(TBD)
V40.7.3-9	i. Minimum Swath Width	1700 km (TBR)	(TBD)

3.2.1.1.1.**20** Littoral Sediment Transport

Littoral sediment transport is defined as the transport of **deposited, bottom-lying** sediment **in ocean coastal areas** by river systems and along-shore ocean currents. More specifically, **it** is defined as the change in the volume of sediment **on the floor of the ocean** in **a horizontal** cell **in an ocean coastal area** since the last measurement divided by the time interval between measurements. **Sediments suspended within the water are not addressed by this EDR. (See Mass Loading/Turbidity.)** This EDR is required under clear and daytime conditions only**, and does not apply to portions of ocean channels or river deltas narrower than the horizontal cell size objective**.

Units: m^3/day

Para. No.		Thresholds	Objectives
V40.7.4-1	a. Horizontal Cell Size	1.3 km (TBR)	0.1 km (TBR)
V40.7.4-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.4-3	c. Horizontal Coverage	Rivers, ocean coastal regions	Rivers, ocean coastal regions
V40.7.4-4	d. Measurement Range	(TBD)	(TBD)
V40.7.4-5	e. Measurement Accuracy	Greater of 30 % and (TBD)	Greater of 15 % and (TBD)
V40.7.4-6	f. Measurement Precision	Greater of 40 % and (TBD)	Greater of 15 % and (TBD)
V40.7.4-7	g. Mapping Uncertainty	3 km	0.1 km
	h. Maximum Local Average Revisit Time	48 hrs	12 hrs
	i. Maximum Local Refresh	(TBD)	(TBD)
V40.7.4-8	j. Minimum Swath Width	1700 km(TBR)	(TBD)

3.2.1.1.1.**21** Net Heat Flux

Net heat flux refers to net surface flux of heat over oceans.
Components are long-wave and short-wave radiation, latent heat flux, and sensible heat flux. The requirements below apply under clear conditions **only**.

Units: W/m^2

Para. No.		Thresholds	Objectives
V40.7.5-1	a. Horizontal Cell Size	20 km	5 km
V40.7.5-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.5-3	c. Horizontal Coverage	Oceans	Oceans
V40.7.5-4	d. Measurement Range(TBR)	0 - 1000 W/m^2	0 - 2000 W/m^2
V40.7.5-5	e. Measurement Accuracy	10 W/m^2	1 W/m^2
V40.7.5-6	f. Measurement Precision	5 W/m^2	1 W/m^2
V40.7.5-7	g. Mapping Uncertainty	7 km	(TBD)
	h. Maximum Local Average Revisit Time	6 hrs	3 hrs
	i. Maximum Local Refresh	(TBD)	(TBD)
V40.7.5-8	j. Minimum Swath Width	3000 km(TBR)	(TBD)

3.2.1.1.1.2**2** Ocean Color/Chlorophyll

The required data product is the concentration of chlorophyll in a vertical column of the ocean, and the requirements below apply to this product. Ocean color, as measured by the radiance reflected by the ocean in a number of narrow visible bands, is typically used to infer chlorophyll concentration. This EDR is required under clear, daytime conditions only.

Units: mg/m^3

Para. No.		Thresholds	Objectives
	a. Horizontal Cell Size		
V40.7.6-1	1. Global, worst case	2.6 km	1 km
V40.7.6-2	2. Regional (Coastal), worst case	1.3 km	0.1 km
V40.7.6-3	b. Horizontal Reporting Interval	(TBD)	(TBD)
	c. Horizontal Coverage	Oceans	Oceans
V40.7.6-4	1. Global	> 370 km from coastline	> 370 km from coastline
V40.7.6-5	2. Regional (Coastal)	≤ 370 km from coastline	≤ 370 km from coastline
V40.7.6-6	d. Measurement Range	0.05 - 50 mg/m^3	0 - 100 mg/m^3
V40.7.6-7	e. Measurement Accuracy	The > of 30 % or TBD mg/m^3	The > of 30 % or TBD mg/m^3
V40.7.6-8	f. Measurement Precision	The > of 20 % or TBD mg/m^3	The > of 10 % or TBD mg/m^3
	g. Mapping Uncertainty		
V40.7.6-9	1. Global	3 km	0.5 km
V40.7.6-10	2. Regional	3 km	0.1 km
	h. Maximum Local Average Revisit Time	48 hrs	12 hrs
	i. Maximum Local Refresh	(TBD)	(TBD)
V40.7.6-11	j. Minimum Swath Width	1700 km (TBR)	(TBD)

3.2.1.1.1.2**3** Sea Ice Age and Sea Ice Edge Motion

Sea ice age is defined as the time that has passed since the formation of the surface layer of an ice covered region of the ocean. The content of the sea ice age EDR is the typing of areas of sea ice by age. Sea ice motion is defined as the displacement of a sea ice edge. The requirements below apply under clear conditions **only**.

Units:
Ice age: Class
Ice edge motion: km/day

Para. No.		Thresholds	Objectives
V40.7.8-1	a. Horizontal Cell Size (Ice Age)	3 km	0.1 km
V40.7.8-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.8-3	c. Horizontal Coverage	Oceans	Oceans
	d. Measurement Range		
V40.7.8-4	1. Ice Age Classes	First Year, Multi-year (TBR)	New, Young, First Year, and Old (TBR)
V40.7.8-5	2. Ice Motion	0 - 50 km/day	0 - 50 km/day
V40.7.8-6	e. Probability of Correct Typing (Ice Age)	70 %	90 %
V40.7.8-7	f. Measurement Uncertainty (Ice motion)	1 km/day	0.1 km/day
V40.7.8-8	g. Mapping Uncertainty	3 km	1 km
	h. Maximum Local Average Revisit Time	24 hrs	12 hrs
	i. Maximum Local Refresh	(TBD)	(TBD)
V40.7.8-9	j. Minimum Swath Width	3000 km (TBR)	(TBD)

3.2.1.1.1.2**4** Mass Loading (TBR) (IORD **Name:** Turbidity)

Mass loading is defined as the concentration of suspended matter in a vertical column in the ocean. This quantity is referred to as "turbidity" in the IORD because it is used to derive both rates of sediment deposition and optical clarity. The depth of the vertical column is specified by the vertical cell size. Turbidity may be derived from ocean color data. The requirements below apply only under clear conditions.

Units: mg/l

Para. No.		Thresholds	Objectives
V40.7.11-1	a. Horizontal Cell Size	1.3 km	0.25 km
V40.7.11-2	b. Horizontal Reporting Interval	(TBD)	(TBD)
V40.7.11-3	c. Horizontal Coverage	Oceans	Oceans
V40.7.11-4	d. Vertical Cell Size	Surface layer ((TBD) m)	(TBD)
V40.7.11-5	e. Measurement Range	(TBD)	0 - 100 mg/l
V40.7.11-6	f. Measurement Accuracy	Greater of 30 % and (TBD)	0.1 mg/l
V40.7.11-7	g. Measurement Precision	(TBD)	0.1 mg/l
V40.7.11-8	h. Mapping Uncertainty	(TBD)	0.5 km
	i. Maximum Local Average Revisit Time	48 hrs	24 hrs
	j. Maximum Local Refresh	(TBD)	(TBD)
V40.7.11-9	k. Minimum Swath Width	1700 km (TBR)	(TBD)

3.2.1.1.2 Modifications and Clarifications of EDR Requirements

The modifications and clarifications of EDR requirements in section 3.2.1.1.2 take precedence over any conflicting requirements or statements in section 3.2.1.1.1, Appendix D of the TRD, or the IORD.

3.2.1.1.2.1 EDR Requirements Applying Under Clear Conditions Only

SRDV3.2.1.1.2.1-1
Requirements for the following EDRs **(with references to sections of the TRD Appendix D in parentheses)** shall be fully met under clear conditions, but need not be fully met under cloudy conditions using sensing data from the VIIRS alone:

- Sea Surface Temperature (Appendix D, Sec. 40.2.4)
- Soil Moisture (Appendix D, Sec. 40.2.6)
- Aerosol Optical Thickness (Appendix D, Sec. 40.3.1.1)
- Aerosol Particle Size Parameter (Appendix D, Sec. 40.3.1.2)
- Suspended Matter (Appendix D, Sec. 40.3.1.3)
- Albedo (Surface) (Appendix D, Sec. 40.5.2)
- Land Surface Temperature (Appendix D, Sec. 40.6.1)
- Normalized Differential Vegetative Index (Appendix D, Sec. 40.6.2)
- Snow Cover/Depth (Appendix D, Sec. 40.6.3)
- Vegetation **Index**/Surface Type (Appendix D, Sec. 40.6.4)
- Ocean Currents (Near Shore/Surface) (Appendix D, Sec. 40.7.1)
- Fresh Water Ice (Appendix D, Sec. 40.7.2)
- Ice Surface Temperature (Appendix D, Sec. 40.7.3)
- Littoral Sediment Transport (Appendix D, Sec. 40.7.4)
- Net Heat Flux (Appendix D, Sec. 40.7.5)
- Ocean Color/Chlorophyll (Appendix D, Sec. 40.7.6)
- Sea Ice Age/Edge Motion (Appendix D, Sec. 40.7.8)
- Mass Loading (IORD Name: Turbidity) (Appendix D, Sec. 40.7.9)

Definitions of “clear” and “cloudy” appear in Section 40.1.8.1 of **the TRD** Appendix D, for guidance purposes. The definition of “detectable cloud," to which the term “cloud” always refers in this document, is in the Glossary in Appendix A.

SRDV3.2.1.1.2.1-2
The contractor shall recommend definitions of “clear” and “cloudy.” Different definitions may be proposed for different EDRs.

Under cloudy conditions, these EDRs should be provided on an as-capable basis, possibly with degraded data quality and completeness. In particular, the Aerosol Optical

Thickness, Aerosol Particle Size Parameter, and Suspended Matter EDRs should be provided above the clouds under cloudy conditions using VIIRS sensing data.

3.2.1.1.2.2 EDR Requirements Applying Under Daytime Conditions Only

SRDV3.2.1.1.2.2-1
Requirements for the following EDRs **(with references to sections of the TRD Appendix D in parentheses)** shall be fully met under daytime conditions, and should be fully or partially met under non-daytime conditions, if feasible, using sensing data from the VIIRS alone:

- Aerosol Optical Thickness (Appendix D, Sec. 40.3.1.1)
- Aerosol Particle Size Parameter (Appendix D, Sec. 40.3.1.2)
- Suspended Matter (Appendix D, Sec. 40.3.1.3)
- Cloud Effective Particle Size (Appendix D, Sec. 40.4.3)
- Cloud Optical Thickness (Appendix D, Sec. 40.4.6)
- Albedo (Surface) (Appendix D, Sec. 40.5.2)
- Normalized Differential Vegetative Index (Appendix D, Sec. 40.6.2)
- Snow Cover/Depth (Appendix D, Sec. 40.6.3)
- Vegetation **Index**/Surface Type (Appendix D, Sec. 40.6.4)
- Littoral Sediment Transport (Appendix D, Sec. 40.7.4)
- Ocean Color/Chlorophyll (Appendix D, Sec. 40.7.6)
- Mass Loading (IORD Name: Turbidity) (Appendix D, Sec. 40.7.9)

SRDV3.2.1.1.2.2-2
The contractor shall determine the radiance levels in appropriate bands that will define "daytime conditions" for each of these EDRs. Daytime conditions need not be defined in the same way for different EDRs.

Under non-daytime conditions these EDRs should be provided on an as-capable basis, possibly with degraded data quality and completeness.

3.2.1.2 Operational SDR Requirements (TBR)

In processing RDRs into EDRs, the IDPS will generate intermediate-level satellite instrument data files, including Sensor Data Records (SDRs). SDRs are needed for retrospective processing, leading to improved methods, and for archival, for long-term sensor evaluation, or troubleshooting. SDRs will be delivered to the same user destinations as the associated EDRs, as specified in the EDR/RDR matrix (Appendix E), which lists delivery destinations of RDRs/EDRs. The generation and delivery of operational SDRs will be the responsibility of the IDPS (TSPR) contractor, not the VIIRS contractor.

3.2.1.2.1 Operational SDR Content (TBR)

At a minimum, operational SDRs will include the following information:

- SDR identification tag
- Spacecraft identification tag
- Sensor identification tag
- Flight software version number
- Data Mode (LDR, HDR, Regional, Global, Early-orbit types)
- Data acquisition orbit number
- Data transmission orbit number
- Spacecraft Orientation
- Beginning Julian date and time tag
- Ending Julian date and time tag
- Ascending Node Julian date and time tag
- Identification of RDRs, databases, algorithms, and other ancillary data used to generate the SDR
- Channel identification
- Calibrated in-band Earth radiance per sample
- Calibration source radiance data
- Calibration hardware instrumentation data
- Identification of type and time of calibration data acquisition for all calibrations utilized
- Earth location (latitude/longitude) information
- Solar elevation angle (nadir)
- Lunar phase angle(nadir)
- Lunar elevation angle (nadir)
- Scan or stare index
- Beginning and end times of scan or stare
- Data sufficient to allow calculation of time tag for each sample to the nearest millisecond
- Internal sensor temperatures, voltages, and currents

The IDPS (TSPR) contractor, not the VIIRS contractor, will be responsible for defining the content of operational SDRs.

The VIIRS contractor may recommend the content of operational SDRs. The government, at its discretion, may provide this recommendation to the IDPS (TSPR) contractor.

SRDV3.2.1.2.1-1
The VIIRS contractor shall participate in technical interchange meetings with the IDPS (TSPR) contractor to support the definition of the operational SDRs with respect to both content and format, if so requested by the government.

The VIIRS contractor will determine the content of non-operational SDRs generated by the contractor for requirements validation purposes.

3.2.1.2.2 Operational SDR Format

The IDPS (TSPR) contractor, not the VIIRS contractor, will be responsible for defining the format of operational SDRs.

The VIIRS contractor may recommend the format of operational SDRs. The government, at its discretion, may provide these recommendations to the IDPS (TSPR) contractor.

The VIIRS contractor will determine the format of non-operational SDRs generated by the contractor for requirements validation purposes.

3.2.1.3 Operational RDR Requirements (TBR)

Because RDRs are processed into EDRs, RDRs are considered to have met their requirements when they are of an appropriate format, completeness, and quality to be adequately processed into their associated EDRs.

SRDV3.2.1.3-1
The VIIRS contractor shall be responsible for generating operational RDRs.

3.2.1.3.1 Operational RDR Content (TBR)

SRDV3.2.1.3.1-1
At a minimum, operational RDRs shall include the following data:

- Channel identification
- Compression information (if used)
- Uncalibrated Earth scene radiometric data (compressed or raw)
- Calibration source raw radiometric data
- Calibration hardware instrumentation data
- Identification of type and time of calibration data acquisition for all calibrations utilized
- Sensor related data necessary for geolocation of samples
- Scan or stare index
- Beginning and end times of scan or stare
- Data sufficient to allow calculation of time tag for each sample

SRDV3.2.1.3.1-2
The following data, at a minimum, shall be appended to or incorporated in an operational RDR at least every five minutes:

- RDR identification tag
- Spacecraft identification tag
- Sensor identification tag
- Flight software version number
- Spacecraft related data necessary for geolocation
- Data mode (LDR, HDR, Regional, Global, Early-orbit types)
- Data acquisition orbit number
- Data transmission orbit number
- Critical sensor temperatures, voltages, and currents
- Ascending Node Julian date and time tag

3.2.1.3.2 Operational RDR Format (TBR)

SRDV3.2.1.3.2-1
The contractor shall determine the RDR format for each mode within the packet envelopes.

3.2.1.4 Earth Location Requirements

SRDV3.2.1.4-1
The VIIRS shall be designed so that with scientific geolocation algorithms (adopted, adapted, or developed by the contractor) the mapping uncertainty requirements of all primary EDRs will be met. Spacecraft and spacecraft/payload interface characteristics which contribute to geolocation errors are specified in Section 3.2.4.2.1.3.

SRDV3.2.1.4-2
The contractor shall recommend sensor requirements necessary to meet the mapping uncertainty requirements of the primary EDRs.

3.2.1.5 Algorithms (TBR)

3.2.1.5.1 Scope

SRDV3.2.1.5.1-1
The contractor shall adopt or adapt existing algorithms or develop new scientific algorithms for all primary EDRs. (See Section 3.2.1.1.1.) Adopting an algorithm means using an existing algorithm without change. Adapting an algorithm means using an existing algorithm with some modification, such as different values of coefficients, inclusion of higher order corrections, fusion of additional data sources, etc.

SRDV3.2.1.5.1-2
The contractor shall also adopt or adapt existing algorithms or develop new scientific algorithms for all intermediate level data products used to generate the primary EDRs, such as SDRs and flags indicating data quality, daytime versus nighttime, clear versus cloudy, etc. **Because** the VIIRS contractor is not responsible for the content or format of operational SDRs, the VIIRS contractor may select the appropriate intermediate-level data products needed as inputs to his scientific EDR algorithms in satisfying this requirement. The description of operational SDRs in Section 3.2.1.2 is provided as guidance. Algorithms need not be provided for data products that are generated by other sensor suites and utilized as inputs to the algorithms for VIIRS primary EDRs.

3.2.1.5.2 Performance Requirements

SRDV3.2.1.5.2-1
The performance of the scientific EDR algorithms delivered by the VIIRS contractor shall meet EDR thresholds and shall be no worse than the performance of algorithms utilized for current (TBR) operational data products for these EDRs, if such operational products exist.

3.2.1.5.3 Operational Algorithm Teams (OATs)

The government's Operational Algorithm Teams (OATs) may recommend scientific algorithms. These teams have contributed to the definition of the instrument requirements of Section 3. The OATs may also provide advisory information on VIIRS functional and calibration requirements.

3.2.1.5.4 Convertibility to Operational Code

The government considers the SDR and EDR algorithms adopted, adapted, or developed by the VIIRS contractor to be scientific, rather than operational, algorithms. The VIIRS contractor is not responsible for identifying or developing operational SDR and EDR algorithms for the VIIRS. (Any operational algorithms necessary for the generation of RDRs will ultimately be the responsibility of the VIIRS contractor, and the operational code implementing these algorithms will be part of the required flight software. This statement applies to the post-downselect phase of the VIIRS program.)

SRDV3.2.1.5.4-1
The scientific SDR and EDR algorithms delivered by the VIIRS contractor shall be convertible into operational code that is compatible with a 20 minute maximum processing time at either the DoD Centrals or DoD field terminals for the conversion of all pertinent RDRs into all required EDRs for the site or terminal, including those based wholly or in part on data from other sensor suites. The intent of this requirement is to preclude algorithms that are so computationally intensive that any foreseeable implementation would stress or exceed the time available for delivery of EDRs in an operational environment.

SRDV3.2.1.5.4-2
The means by which the contractor shall validate the requirement that scientific algorithms be convertible to operational code subject to the constraint specified in SRDV3.2.1.5.4-1 is TBR.

SRDV3.2.1.5.4-3
The availability of any inputs required from databases or other ancillary sources to generate data products shall also be adequate to allow EDRs to be generated at the DoD Centrals and DoD field terminals within the time constraint specified in SRDV3.2.1.5.4-1.

3.2.1.5.5 Multiple Sensor Requirements

SRDV3.2.1.5.5-1
The contractor shall identify any constraints on the relationships between sensors within VIIRS (if VIIRS is comprised of more than one sensor) or between sensors in different sensor suites that are entailed by the contractor's algorithms for the VIIRS primary EDRs which require data from multiple sensors. Such constraints might include, for example, relative pointing knowledge, relative pointing accuracy, co-boresighting, synchronization, etc. Based on this information and the corresponding information from other sensor contractors, the government may impose modified or additional requirements on the VIIRS and/or other sensor suites. (See Sec. 3.2.2.)

3.2.1.6 Standard Earth Scenes

The NPOESS IPO will provide up to 5 images in each of the 44 (TBR) categories/areas listed below for use in developing sensor designs, and in verifying sensor and algorithm performance. The government will create an additional set of up to 5 images in each area/category which will be used by the government to determine sensor design performance and algorithm performance.

Terrain areas and categories for standard scenes (TBR). There are 24 areas in all. For each area except polar, there will be day and night categories as well, making the total 44 areas/categories of standard datasets. The areas will all be 360 km X 360 km (3.25° X 3.25°) anchored at the NW corner identified **in the table below**.

Climate Area	Spring	Summer	Autumn	Winter	Location (NW Corner)
Polar					
Land: Siberia		X		X	70N 103E
Coast: Point Barrow		X		X	72N 159W
Tropics					
Land: Amazon Basin		X		X	5S 65W
Coast: Cameroon		X		X	5N 8E
Ocean: E. Pacific		X			8N 120W
Midlatitudes					
Land: W. Urals	X	X	X	X	56N 56E
Coast: Olympic Peninsula	X	X	X	X	48N 126W
Desert: Great Basin	X	X	X	X	41N 118W
Ocean: Azores				X	45N 30W
Alpine: Swiss Alps			X		48N 8E
Sub-Tropical: Bangladesh				X	25N 88E

Images will have a ground sample distance (GSD) of 200m (TBR) and will include 1800 X 1800 (TBR) GSD elements (pixels). These images will represent top of the atmosphere radiance in-band, with bands selected by the contractor to match their sensor bands. The number of image channels modeled will not exceed 15. Contractors with more than 15 channels in their design must select which 15 channels they desire as standard scenes. After delivery of the initial set of images, contractors may request copies of the executable models and the input datasets and commands used to create the images if they wish to generate additional scenes in other channels. Sensor relative spectral responsivity will be assumed to be a top-hat (TBR), **because** alternate sensor response functions can be characterized and calibrated out.

Terrain data underlying the images will be constructed from Landsat Thematic Mapper data taken from 2 X 3 contiguous mosaics of cloud free collections (TBR). Clouds will be inserted into the images using a TBS technique. Top of the atmosphere radiance values will be computed using MODTRAN v 3.0. Image files will be supplied as binary data in raster format, with a 32 bit floating point value for each pixel, and with 1 band per file (TBR). Files will be supplied on Tape Archives (TAR) tapes (TBR).

3.2.1.7 Real-time Data Downlink Data

SRDV3.2.1.7-1
The VIIRS shall create real-time data packets for transmission to the ground in the real-time data links (LDR, HDR) and transmit them to the spacecraft data handler. (TBR)

3.2.1.8 Stored Data Downlink Data

SRDV3.2.1.8-1
The VIIRS shall create two types of data packets for transmission to the spacecraft storage system: (1) a global resolution and (2) a regional resolution data packet. (TBR)

3.2.1.9 Data Formatting and Compression (TBR)

SRDV3.2.1.9-1
The data packets generated by the VIIRS shall conform to the Consultative Committee for Space Data Systems (CCSDS) packetization per the (TBS) real-time interface specification and the (TBS) stored-data interface specification.

SRDV3.2.1.9-2
If data compression techniques are utilized by the VIIRS in generating data packets for storage on-orbit, the compression shall be lossless.

SRDV3.2.1.9-3
The VIIRS may utilize lossy data compression in generating data packets for real time transmission of mission data to field terminals via either high or low data rate links, with the exception of sensor calibration data.

SRDV3.2.1.9-4
If the VIIRS utilizes data compression techniques in generating data packets for real-time transmission of sensor calibration data to field terminals via either high or low data rate links, the compression shall be lossless.

SRDV3.2.1.9-5
The VIIRS contractor shall identify and quantify any EDR performance degradation at the field terminals resulting from the use of lossy data compression.

3.2.1.10 Scan Requirements (TBD)

3.2.1.10.1 Type of Scan (TBD)

"Scan type" refers to the geometrical mode in which the scene is scanned, e.g., whiskbroom, pushbroom, cross-track, conical, etc.

3.2.1.10.2 Swath Width (TBD)

The swath width should be the same for all instruments in the suite to facilitate synergistic use of data from different instruments.

3.2.1.10.3 Scan-to-scan Separation (Overlap/Underlap at Nadir) (TBD)

3.2.1.10.4 Number and Types of Scan Modes (e.g., Normal, Calibration, Autonomous, or Commandable) (TBD)

3.2.1.10.5 Scan Rate (TBD)

3.2.1.11 Center Frequency or Wavelength (TBD)

3.2.1.12 Bandpass Limits (N % Response Frequencies, where N = 50, 10, 1, etc.) (TBD)

3.2.1.13 Dynamic Range (TBD)

3.2.1.14 Linearity (TBD)

3.2.1.15 Quantization (TBD)

3.2.1.16 Sensitivity (TBD)

3.2.1.17 Absolute Radiometric Accuracy and Stability (TBD)

3.2.1.17.1 Absolute Accuracy (TBD)

3.2.1.17.2 Short-term Stability (TBD)

3.2.1.17.3 Long-term Stability (TBD)

3.2.1.17.4 Inter-band Accuracy (TBD)

3.2.1.18 Sensor Calibration (TBD)

SRDV3.2.1.18-1
The VIIRS shall perform periodic autonomous or ground controlled mission sensor calibration as required.

3.2.1.18.1 Type of Calibration (TBD)

3.2.1.18.2 Frequency of Calibration (TBD)

3.2.1.18.3 Calibration Source Requirements (Emissivities, Temperatures, etc.) (TBD)

3.2.1.18.4 Calibration Source Monitoring Requirements (TBD)

3.2.1.18.5 Sensor Electronic Response Monitoring Requirements (TBD)

3.2.1.19 Spatial Resolution (Bounds on MTF at Specified Spatial Frequencies or Bounding Curves) (TBD)

3.2.1.20 Horizontal Sampling Interval (TBD)

3.2.1.21 Instantaneous Field of View (IFOV) (TBD)

3.2.1.21.1 IFOV Width at 50% Response Points (TBD)

3.2.1.21.2 IFOV Width Uniformity (Detector-to-Detector) (TBD)

3.2.1.21.3 Response Uniformity (Intra-IFOV) (TBD)

3.2.1.21.4 Out-of-Field Response (Bound on Integrated Response Outside the IFOV) (TBD)

3.2.1.22 Optical Line-of-Sight (LOS) Alignment (TBD)

3.2.1.22.1 Maximum Misalignment Between Sensor Alignment Reference and LOS Axes (TBD)

3.2.1.22.2 LOS Pointing Knowledge (TBD)

3.2.1.22.3 Co-registration of Spectral Bands (TBD)

3.2.1.22.4 Maximum Allowed Alignment Change (During Ground Test, Launch, or On-orbit) (TBD)

3.2.1.23 Optical Line-of-Sight (LOS) Jitter and Drift Requirements IRD (TBD)

3.2.1.24 Polarization (TBD) (Bound on Sensitivity to Polarization)

3.2.1.25 Crosstalk (Bound on Response in One Channel Due to Signal in Another Channel) (TBD)

3.2.1.26 Out-of-Band Rejection (Bound on Response in a Channel Due to Integrated Out-of-band Signal) (TBD)

3.2.1.27 Intra-band Response Uniformity (TBD)

3.2.1.27.1 Temporal (TBD)

3.2.1.27.2 Spatial (TBD)

3.2.1.28 Stray Light Rejection (TBD)

3.2.2 SENSOR CAPABILITY RELATIONSHIPS

Constraints on relationships between different sensor suites or different sensors within the VIIRS suite entailed by the primary VIIRS EDR algorithms are included in this section. (See Section 3.2.1.5.5.)

3.2.2.1 Reference Timelines (TBS)

3.2.2.2 Relationships Between Sensors in Different Sensor Suites (TBR)

3.2.2.2.1 Relative Pointing Knowledge (TBR)

3.2.2.2.2 Relative Pointing Accuracy (TBR)

3.2.2.2.3 Co-Boresighting (TBR)

3.2.2.2.4 Synchronization (TBR)

3.2.2.3 Relationships between Sensors Within a Suite (TBD)

3.2.3 INTERFACE REQUIREMENTS

The system interfaces relevant to the sensors are depicted in Figure 3.2.3 below.

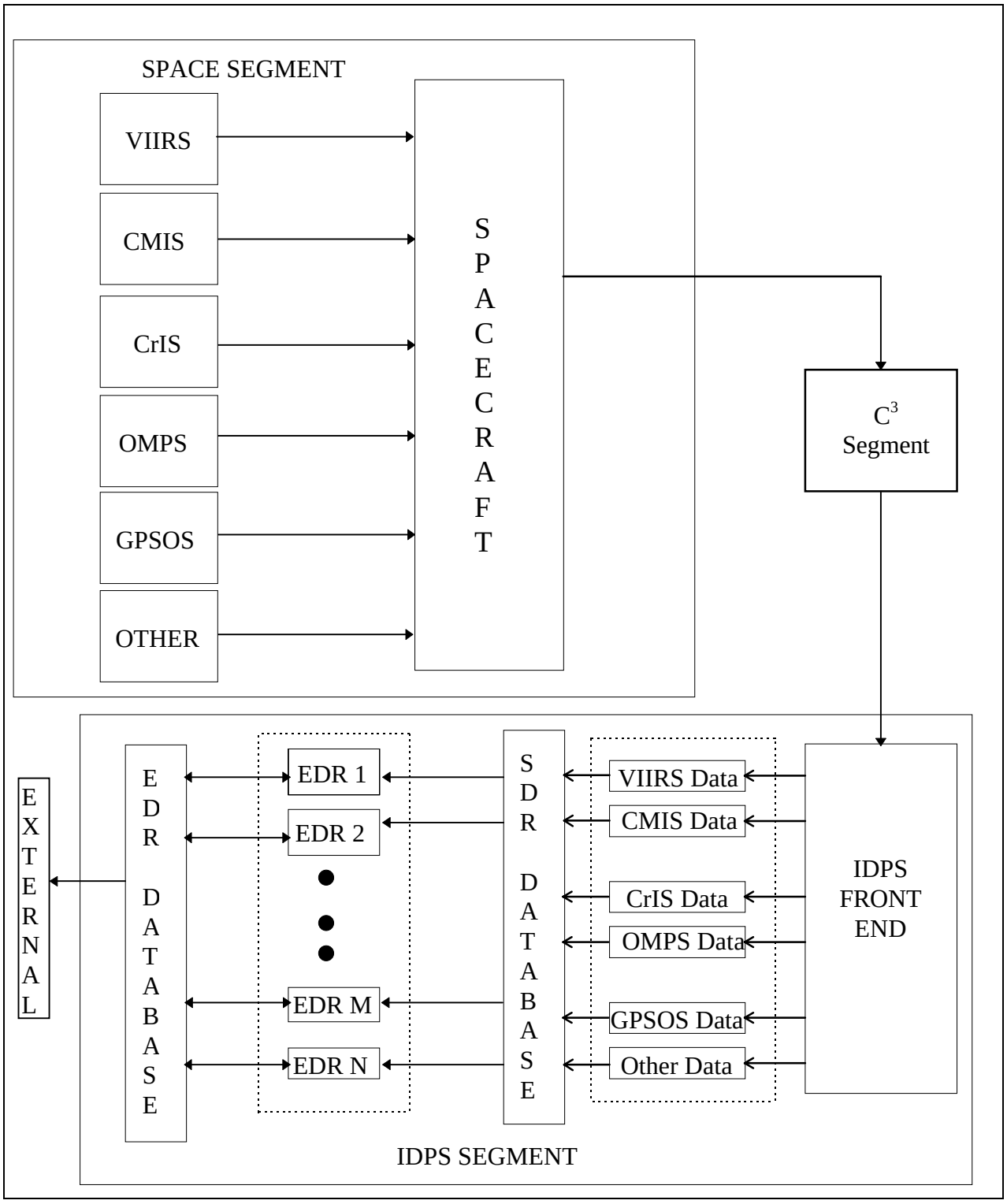

Figure 3.2.3 Partial System Internal Interfaces

3.2.4 PHYSICAL AND INTERFACE CHARACTERISTICS

Mass, dimensions, power, and data rates specified herein are nominal values (with contingency) which were developed during initial studies at the Integrated Program Office. All values are TBR, indicating that specific allocations are negotiable. It is presently planned that definitive allocations will be defined by the IPO, in consultation with sensor contractors, by the time of the SRR. In the interim, contractors should keep in mind that relaxation from nominal allocations will only be possible if changes are consistent with the requirement to accommodate the full NPOESS payload suite of instruments on a spacecraft which can be placed into a nominal 833 km orbit by an EELV class launch vehicle.

SRDV3.2.4-1
The mass of the VIIRS sensor shall be less than or equal to 132 kilograms (TBR).

SRDV3.2.4-2
The dimensions of the VIIRS sensor shall be less than or equal to the following limits:

a) Velocity direction: 129 centimeters (TBR).
b) Nadir direction: 65 centimeters (TBR).
c) Anti-Solar direction: 138 centimeters (TBR).

Dimensions of components mounted internal to the spacecraft bus are TBD.

SRDV3.2.4-3
The power consumption (orbit average) of the VIIRS sensor shall be less than or equal to 215 Watts (TBR).

SRDV3.2.4-4
The data rate (orbit average) of the VIIRS sensor shall be less than or equal to the following limits:

a) Regional (high resolution) stored data rate: 3400 kilobits per second (TBR).
b) Regional (high resolution) real-time data rate: 3400 kilobits per second (TBR).
c) Global (medium resolution) stored data rate: 600 kilobits per second (TBR).
d) Global (medium resolution) real-time data rate: 132 kilobits per second (TBR).

Continued in Common Section, Rev1